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LOAD-FACTORS AND DIVERSITY-FACTORS.

Although several definitions have been put forward to explain the meaning of "load-factor" and "diversity-factor," the definitions introduced by Mr. Robert Hammond and also by Mr. Arthur Wright have been generally accepted.

Load-factor is the ratio of the average load, represented by actual sales to consumers, to the maximum load supplied to the feeders at the station, expressed as a percentage; that is to say, it is the number of units sold during the year times 100, divided by 365 times twenty-four times the maximum load.

It is thus evident that even if all the consumers had a steady twenty-four-hour load, the load-factor as thus defined could not be 100 per cent, for the average load represented by the number of units sold, divided by the proper denominator, includes the losses in distribution. This may be a considerable percentage, especially in the case of alternating-current transformer systems. Ambiguity sometimes occurs, because some engineers take the maximum load as the total maximum load on the bus-bars, including the power used on the works. Others take only the maximum load supplied to the feeders, which is conceded to be the more correct way. If the power used at the works is included, the load-factor will often come out at a much lower figure.

The diversity-factor is the ratio of the sum of the consumers' demands to the maximum demand on the feeders at the station bus-bars. It is thus always greater than unity, although there can be a hypothetical case in which the consumers' maximum demands might occur simultaneously, in which case the demand on the feeders would be greater, as it would include the distribution losses; so that, in this instance, the diversity-factor, in accordance with the accepted definition, would actually be somewhat below unity.

In calculating diversity-factor, the station auxiliaries and lighting may be regarded as a consumer if desired, in which case the ratio would be taken as the sum of the consumers' maximum demands and the maximum demand by the station auxiliaries and lighting to the maximum power delivered from the bus-bars, including the power used on the works.

This analysis of load-factors and diversity-factors formed the subject of Mr. W. W. Lackie's address as chairman before the Glasgow local section of the Institution of Electrical Engineers, of Great Britain, last month. Mr. Lackie is engineer-in-chief of the Glasgow Electricity Department. Aside from his very interesting analysis of the definitions and usages of these two terms, Mr. Lackie made a suggestion which provides a very generous portion of food for thought. In Glasgow, as in other

large industrial centres, the power-station engineer finds the power load creeping up to, and often overtaking, the lighting load, as electricity becomes more generally used. The power load also is fairly steady, and the variation in total output follows almost directly the growth of the system. On the other hand, the lighting load varies considerably with the season, and also varies from day to day, according to the amount of sunlight which the vagaries of the weather make available. In Glasgow the lighting customers are charged at a flat rate for a maximum demand, and power customers are charged on a similar system, but at a lower rate. If a set of customers do not use their maximum demand, they do not pay all their standing charges, and are therefore a loss to the undertaking, notwithstanding the fact that throughout they have to pay a higher rate under a maximum-demand system. A consumer paying the maximum charge per unit may be an unprofitable consumer, while an industrial consumer paying a lower price per unit throughout for a long-hour power supply will make a solid contribution to the profits of the supply undertaking.

Mr. Lackie states that at present many companies and supply authorities in supplying energy for power purposes allow their consumers to use five or ten per cent, and in some cases twenty per cent, of their consumption for lighting, the whole being charged at power rates. If this is right, he considers we may look forward to a time when the total demand for lighting will be, say, only ten per cent of the total output, the other ninety per cent being used for power and heating purposes; and electrical energy used for lighting purposes will then be thrown in at a price corresponding to our charge for power today. The effect of the metallic-filament lamp helps on this idea by reducing the present demand and corresponding consumption of energy for lighting purposes; whereas we feel certain that no such vital change in the efficiency of motors can take place so as to reduce, in a similar manner, the demand made by our power consumers.

ELECTROBUS COSTS.

What appears to be a reasonably authentic summarization of operating costs and earnings of electrobuses has been made public by one of the companies operating a system of public electric carriers in London, England. When the London system was inaugurated about eighteen months ago, we raised a question as to whether profitable operation would be possible at the rate of fare charged, taking into consideration the heavy depreciation on all parts of the system and the high cost of current for electrical charging of the storage batteries.

From the reports of the auditors of the company operating the electrobuses, it appears that, contrary to general expectations, the service has become very popular, and that as the number of carriages has been increased, the revenue per carriage-mile has also increased. While for the first three months the earnings were considerably less than the cost of operation plus the overhead and establishment expenses, the revenue for the fifteen months ending last October was sufficient to pay operating costs, ulterior expenses, and leave a small profit.

TRANSPORTATION DEVELOPMENTS IN BOSTON.

The opening of the new Washington Street tunnel in Boston on Monday, November 30, marks a definite step forward in the working out of a comprehensive scheme of transportation for the larger community of which that city is the centre. Although the tunnel is but a little over a mile in length, it illustrates the latest ideas in the field of engineering design and construction, and in its relation to the existing elevated system of the city, it assumes a position of fundamental importance. In the past, the most densely populated shopping district of Boston has been well served by surface cars, and later by the nearness of the Tremont Street subway, but today the inauguration of travel in the new tunnel shortens the gap between the residential districts of the north and south and the retail centre and financial section to an extent only a citizen of the Hub can fully appreciate. The restoration of surface car traffic in the original subway will shortly be completed, and with the clear result that on its north and south axis Boston will be finely provided with facilities for real rapid transit.

The completion of the Forest Hills elevated extension and the pushing of the elevated lines into the Malden and Everett section will still further strengthen the situation, and with the East Boston tunnel, will furnish service of a high character radially into and out of Boston through an arc of about two hundred and seventy degrees. Already active plans are under way for the building of a subway to Harvard Square, Cambridge, with a rapid transit extension in the near future to East Cambridge, and a little farther in the future, the building of a subway under the South Embankment of the Charles River for the special service of the directly western suburban territory. Thus, there appears to be work enough ahead to keep both the Boston Elevated Railway Company and the Boston Transit Commission busy for some years to come. Although facilities are often outrun by traffic in these days of urban expansion, each new route opened affords a considerable measure of relief, and the people of Boston are to be congratulated on this latest addition to their underground lines, which avoids the features which experience has shown undesirable in the earlier subway construction and sets a standard toward which future workers may well look in their efforts to develop high speed underground travel according to the most advanced resources of engineering.

THE TRAINING OF WORKMEN.

It is not long since Mr. F. W. Taylor, in his classic paper before a meeting of the American Society of Mechanical Engineers, outlined a system of training and rewarding workmen which attracted the greatest attention from shop managers and educators in general. The optimism with which Mr. Taylor developed and presented his ideas had the hearty support of that master mind, Dr. Robert H. Thurston, but those in charge of large organizations of workmen were skeptical, and there have been few actual trials of the system outlined. It can be stated as a fact, however, that this system, in connection with the other work of Mr. Taylor, has so greatly increased the output and reduced the cost of work in the large machine shop of the Bethlehem Steel Company that for the past seven years

Mr. H. L. Gantt has given a large portion of his time to the development of its possibilities. In an address before the recent New York meeting of the American Society of Mechanical Engineers, Mr. Gantt made the statement that the results have far exceeded his expectations.

Under the system outlined by Mr. Taylor, each man has his work assigned to him in the form of a task to be done by a prescribed method with definite appliances, and to be completed within a certain time. The task is based on a detailed investigation by a trained expert of the best methods of doing the work. The task-setter or his assistant acts as an instructor to teach the workman to do the work in the manner and in the time specified. If the work is done within the time allowed by the expert, and is up to the standard for quality, the workman receives extra compensation in addition to his day's pay. If it is not done in the time set, or is not up to the standard of quality, the workman receives his day's pay only.

Mr. Gantt holds that people, as a rule, prefer to work at the speed and in the manner to which they have been accustomed, but are usually willing to work at any reasonable speed and in any reasonable manner if sufficient inducement is offered for so doing, and if they are so trained as to be able to earn the reward. The task and bonus method of training not only furnishes the workman with the required knowledge, due to the assistance from trained and expert instructors, but, by offering an inducement to utilize the knowledge properly, the workman is trained in the proper habits of work.

Habits of work in a mechanic are comparable with habits of thought in an engineer. Our industrial schools should make proper habits of work the basis on which to build their training in manual dexterity. The engineering school does not make engineers, but tries to furnish its graduates with an equipment that will enable them to utilize readily and rapidly their own experience and that of others.

Under the task system, workmen are taught how, and trained to do, at the same time. Knowing and doing are thus closely associated. Many skilled workmen make their skill an excuse for slow work, and unless, when they are taught how to do, they are also taught to do efficiently, they never attain the success which should be theirs and thus continually fall short of the economic ideal which shop management might attain to.

So it is evident from Mr. Gantt's experience that there is an economical as well as a humanitarian advantage in striving to bring out and make the greatest use of the best characteristics of the workman. The ordinary workman becomes a gang foreman, then a general foreman and a shop superintendent, because for his ability he stands out above all others. If, in his progress upward, there have been developed in him the proper habits of thought and a passion for doing his work efficiently, the greatest possible gain has been made both for trade and for posterity. One of the most satisfactory evidences of the value of Mr. Gantt's work and his paper describing it was the enthusiastic commendation which was accorded him at the conclusion of his address by the foremost engineers of the day in attendance at the convention.

CANDLEPOWER—FLUX—ILLUMINATION.

The standard candle adopted by the gas referees in London in the year 1860 as the unit of light will continue, with slight modifications, to be the standard of intensity. As a rating for modern light source candlepower of itself has little value, owing to the fact that lamps are rated at the angle of maximum intensity and the angle varies through ninety degrees even in lamps which can be used for similar purposes. For example: The maximum intensity of the majority of incandescent lamps is in the horizontal direction, while the maximum for the downward type of incandescent and the Nernst glower are directly underneath. In the larger units the enclosed arc varies considerably below the horizontal, while the flaming type have characteristics similar to the downward filament and Nernst types. Instead of the maximum intensity the average intensity has been suggested as a rating.

The unit of flux is the mean spherical candlepower multiplied by four, or the "lumens generated." Some authorities have given mean spherical candlepower as the unit of flux, but in the calculation of illumination the "lumens generated" is held to be the more convenient term. The mean spherical candlepower can be readily determined from the polar diagram, and photometers are now available by means of which this value may be obtained with a single reading. There is a variable of considerable importance which is not taken account of with this rating and that lies in the fact that the losses by reflection will be smaller in the case of lamps giving the larger percentage of the total flux below the horizontal.

The unit of illumination is the foot-candle and not candle feet, as the value is sometimes erroneously stated. The efficiency is expressed in the "lumens effective" (watts per square foot per foot-candle). The last named will vary widely with various colors of ceilings and walls, but under the same conditions the ratio of efficiency as represented by the percentage of lumens which are effective as against lumens generated will be in favor of the unit giving the larger flux in the lower hemisphere.

AN ELECTRIC YACHT CHARGING TENDER.

One of the enterprising yachtsmen of the New York Yacht Club has had built for use as an auxiliary to his electric yacht an electric charging launch, which has been named the Kilowatt. This makes the electric launch independent of short charging stations, and, it is stated, gives the yacht a radius of action practically unlimited. The auxiliary carries 400 gallons of gasoline, enabling her to be operated at full power for 100 hours, during which time she can recharge the batteries aboard the electric yacht ten or twelve times, giving a sailing distance of somewhat over 2,000 miles.

The pleasures of a yacht depending upon electric motive power are well known, and attention need hardly be directed again to the advantages of the elimination of smoke and cinders, the lessened possibility of explosion and conflagration, and the doing away with malodorous fumes and gases. The gasoline tender, it is believed, solves the question of the use of electricity in large motor yachts.

Electric Yacht with Charging Tender.

A gasolene and electric charging launch has recently been built by the Electric Launch Company which is to be used in southern waters as an auxiliary to the electric yacht Cascapedia, owned by Benjamin Douglass, Jr. The launch is named Kilowatt and is thirty-five feet long, nine feet beam and two feet draft.

The boat's power equipment consists of a forty-horsepower, six-cylinder gasolene engine, with mechanical reverse-gear connected to the propeller shaft, the engine driving a thirty-horsepower dynamo which is directly connected to the forward end of the engine. It is so arranged that electricity can be generated when the boat is under way or while lying at anchor. A slate switchboard located on the port side of the cabin, with the necessary instruments and switches, distributes the power to the electric yacht for recharging the batteries. The plant has a capacity for recharging the yacht's batteries in three or four hours.

With the Kilowatt as an auxiliary the electric yacht Cascapedia is not dependent upon electricity ashore for recharging her batteries. On one charge the yacht has a capacity of 200 miles, but in connection with the auxiliary charging launch Kilowatt her radius of action is unlimited. The auxiliary launch carries 400 gallons of gasolene, enabling her to be operated at full power for 100 hours, in which time she could recharge the electric yacht ten or twelve times and enable the Cascapedia to cover 2,000 miles before the auxiliary launch would have to replenish her fuel. This is the first electric auxiliary boat ever built, and it does much to solve the question of the use of electricity in large motor boats. The advantages of electricity for cruising boats are well known: Absence of noise, heat and vibration, absolute safety while afloat, no danger of fire or explosion, and ease of control. One man can handle the largest electric yacht. The boat has been shipped to West Palm Beach, Fla., where the owner will use her during the winter.

Independent Wireless Communication Made Possible.

Bellini and Tosi, two Italian scientists, who, with the sanction of the French Government, have been conducting experiments in wireless telegraphy for eighteen months on the coast of Normandy, announce that they have solved the problem of independent wireless communication.

This result, they say, has been secured by means of two rectangular aerials fixed at right angles and so attached to the apparatus for reception and transmission as to permit the passage of unequal currents. By a simple law of mechanics these two electromagnetic forces unite and produce an electromagnetic field, and the Hertzian waves are projected in a single vertical plane, which can be alternated instantly by means of the Bobine device.

The inventors say that they have picked up messages at will from every English wireless station and from ships at sea, and that they have transmitted messages from Courville to Havre and other points without the waves being perceptible at the other stations lying just off the line of transmission.

They claim that their system insures absolutely independent communication and opens up immense advantages in the use of wireless telegraphy.

New York & Ontario Power Company.

Plans and details of the New York & Ontario Power Company, of Waddington, St. Lawrence County, which proposes to furnish waterpower in Northern New York, have been explained to the Public Service Commission, Second District, at a hearing on November 30, on the company's application for permission to issue $1,800,000 in bonds and $654,741 in stock. The commission reserved decision.

It was shown that the company has a possibility of developing 30,000 horsepower, but proposes at the present time to develop 17,200. The power is to come from a stream which flows into the St. Lawrence River, and as a consequence the company believes continuous power is assured without the necessity of a storage dam.

Receivers for Auto Transit Company.

The Auto Transit Company, Philadelphia, being unable to meet its obligations, has been placed in the hands of receivers. The application for the receivership was made by the Electric Storage Company, which supplied power to the electric omnibuses of the Transit Company and was its creditor to the extent of over $30,000. The city of Philadelphia is also a creditor for $2,500 for unpaid licenses and $4,000 for repairs to streets used by the company's vehicles. The service was begun in July, 1907, and although at first popular was not patronized extensively when the fare was raised from five to ten cents to make the receipts meet the expenditures. Should there be a disposition to pay the higher fare needed for the maintenance of the service it will be resumed and the company reorganized.

Westinghouse Company Solvent.

The receivers of the Westinghouse Electric and Manufacturing Company and the Securities Investment Company were discharged in the United States Circuit Court on December 5, by Judge James S. Young.

Petitions for the discharge of the receivers were presented to the court by George Gordon, representing the various consenting interests. The companies were represented as being in sound financial condition. The debts of the Westinghouse Electric and Manufacturing Company have been arranged for, with the exception of unassenting creditors with claims to the amount of about $700,000, who will at once be paid in cash. The company has cash on hand amounting to about $15,000,000. The cash of the Securities Investment Company now on hand is about $17,000,000, with unassenting creditors representing only about $15,000.

Mr. Gordon asked that no account be filed by the receivers, stating that they had reported the condition of the plant from time to time to the company, and that the making of account would interfere greatly with the company at this time. The judge agreed to this motion.

Alaska-Yukon-Pacific Exposition.

During the summer of 1909 the Alaska-Yukon-Pacific Exposition, produced at an estimated cost of $10,000,000, will be held at Seattle, Wash., a commercial seaport of growing importance on the Puget Sound. The exposition will draw upon the territory named in its official title for the major part of its rich exhibits.

The grounds, 250 acres in all, are a part of the campus of the University of Washington, and are beautifuly situated between fresh-water lakes in the midst of a forest of giant trees and in plain sight of several ranges of mountains, including snow-capped Mt. Rainier, at an altitude of 15,000 feet.

Fifteen large buildings, of handsome architectural design, will comprise the exhibition palaces. Besides, the United States Government has expended $600,000 for its own building and exhibits, and fifteen states will be represented by beautiful edifices. A number of foreign countries will participate. The amusement section of the exposition will be known as the Pay Streak, a suggestive term from miners' vernacular. Residents of Seattle give every assurance of perfect weather during the exposition, which will open June 1 and close October 16.

Lewis Institute Branch, American Institute of Electrical Engineers.

One of the most successful meetings ever held by Lewis Institute branch of the American Institute of Electrical Engineers, was that on the evening of December 2, at which an audience of over 400 assembled to hear an address on "Rehabilitation of Chicago Street Railways," by Ralph H. Rice, assistant engineer, Board of Supervising Engineers, Chicago Traction.

Mr. Rice called attention to the prevailing tendency for the public control of all public utilities, which was well illustrated in the new franchises of the Chicago traction companies, in which the Board of Supervising Engineers, thereby created, corresponds to a public-service commission. In tracing the history of the traction problem in Chicago for nearly ten years back, it was evident that the poor service formerly rendered was due to the uncertainty of franchise renewal caused by the agitation for municipal ownership, which resulted in making it impossible to get capital for improvements and rehabilitation of equipment. It was interesting that in a voluminous report on this problem made by Bion J. Arnold in November, 1902, there were recommended most of the features subsequently incorporated in the franchise ordinances of February, 1907. It took nearly five years to secure their adoption, but in the one-and-one-half years since over half the work has been carried into effect.

The main features of these ordinances were pointed out and shown to be far in advance of anything ever attempted in this line. The functions of the supervising engineers in seeing that the provisions are carried out were explained, and the organization and duties of the engineering corps described. The work done by the different branches of this corps was illustrated by considering in detail the typical methods made use of by the division on power distribution, with which the speaker is connected. Preparations of plans, securing of estimates, inspection of the work and progress reports thereon, checking of the companies' accounts and issuance of the final certificate showing proper expenditures to capital account were explained in proper sequence. The speaker then considered at length the engineering features relating to calculation of a feeder system and practical problems met in its installation.

A brief summary of the work done and the amounts expended was given. The Chicago City Railway Company has completed seventy-five miles of rehabilitated and new single track; the Chicago Railways Company sixty-six miles. The former company has laid 2,800,000 duct-feet of conduit and installed 587,000 feet of cable in fifteen months; the latter company has laid 1,260,000 duct-feet of conduit since April 1. An interesting feature in the new equipment is the use of pay-as-you-enter cars, which were successfully introduced for the first time in this country on the South Side lines a year ago and which are being rapidly put in service throughout the city. To the original valuation of the surface traction properties, placed at $50,000,000 at the time of passage of the ordinances, there has been added $21,000,000, which represents approved expenditures for rehabilitation and new equipment, making the total capital account at the present time $71,000,000.

At the conclusion of Mr. Rice's address he met the members of the branch at close range in an upper hall of the Institute and answered many questions in regard to all aspects of the rehabilitation work and particularly in regard to details of its technical features.

Creosote for Railway Ties.

The Pennsylvania Railroad has determined to treat with creosote ties for its main tracks that their life may be prolonged. Some two years ago the company undertook tree planting upon a large scale. Since that time it has set out some 2,425,000 trees and has handled this year some 625,000.

In order to provide still more completely against the future a contract has just been placed for the construction of a tie-treating plant at Mt. Union, Pa., and, in addition, two large creosote storage tanks to be located at Greenwich Point, Philadelphia, Pa. The Mt. Union plant will be the first creosoting operation undertaken on a large scale by an eastern railroad.

It is estimated that proper treatment will increase the life of cross-ties from two to three fold. Applied to all of the 100,000,000 ties which American railroads use annually, it would greatly reduce the drain on the rapidly-decreasing timber resources. The Pennsylvania Railroad alone uses from 3,500,000 to 4,000,000 ties each year. The average life of these red oak and chestnut ties under present conditions is from three to four years, while white oak lasts from seven to eight years.

Revision of Patent Office Rules.

It has been decided to publish a revised edition of the Rules of Practice of the United States Patent Office because of the changes which have been made in such rules since the publication of the last edition. In view of this fact and in order, if possible, to simplify and improve the rules governing the practice before this bureau the Commissioner of Patents desires to obtain suggestions as to amendment of the present rules and would be glad to hear from those interested upon the subject. It is not proposed to make radical amendments to the present rules, but simply to embody such changes in or additions to the rules as will be beneficial both to the office and to applicants. All suggestions should be submitted prior to January 1, 1909, and addressed to Edward B. Moore, Commissioner, United States Patent Office, Washington, D. C.

$2,000,000 Trolley Line to Connect Urban Roads.

A $2,000,000 trolley line will be built which is to connect the Chicago & Milwaukee (the Frost road) with the Ravenswood branch of the Northwestern Elevated at Kedzie Avenue, Chicago. The corporation has been organized by D. H. Louderback, and the funds secured. Chicago capital, exclusively, is enlisted. The tracks are to run from Central Avenue, North Evanston, tapping the Frost line there, to Rockwell Street, Ravenswood, where connection is to be made with the overhead company, a distance of about ten miles.

This territory is well populated. It embraces several suburbs, including McAllister, which is owned by Louderback and his associates. The new company will not come in competition with any urban transportation service.

Chicago & Milwaukee Electric Railroad —New Receivership.

An order assuring the reorganization of the Chicago & Milwaukee Electric Railroad and marking one of the most important steps toward the settlement of the financial difficulties of the interurban line was issued on December 2 by Judge Grosscup. The former receivers were reappointed, but with enlarged duties. The immediate consequence of this action is expected to be the formulation of a plan of financial reorganization, the success of which is apparently assured beforehand by the harmonious action of the holders representing $8,500,000 out of a total of $10,000,000 of bonded indebtedness.

The Power Plant and Transmission System of Castelnuovo-Valdarno, Italy.

BY FRANK KOESTER.

The Societa Mineraria ed Elettrica del Valdarno possesses in the province of Tuscany, near San Giovanni-Valdarno, rich lignite fields. The mining of this coal was not a great commercial success, because it is of a low heating value and contains from forty to fifty per cent moisture. For these reasons it paid to ship only large lumps any distance, and it was not economical to install drying apparatus for that which remained unshipped.

Taking it all in all, the owners of the mine decided to install a steam power plant, in which the inferior coal is utilized to generate electrical energy, which

CASTELNUOVO-VALDARNO PLANT—EXTERIOR VIEW, SHOWING GENERATOR ROOM AND SWITCH HOUSE.

at 33,000 volts is transmitted over five lines to Florence, Prato, Figline, Siena and Valdarno.

The power plant is located directly beside the mine and the boiler room is connected with the latter by a track. The mined coal is exposed to the atmosphere for some time, after which it is conveyed to the overhead bunkers and fed to the boilers of special design. The conveyors are of the bucket type, and besides handling coal are used to remove ashes.

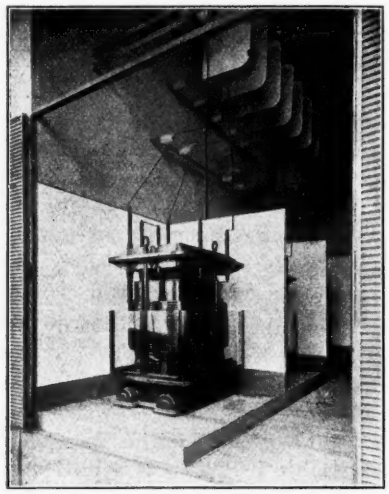
The boiler house is at right angles to the engine room. It is 180 feet long, 98.5 feet in width, and about fifty-five feet high. There are at present installed ten Babcock & Wilcox water-tube boilers having 5,135 square feet of heating surface each. With a coal consumption of 8,100 pounds, each boiler is capable of evaporating 13,200 pounds of water per hour at 190 pounds gauge pressure.

The engine room is 220 feet long and 69 feet wide. The present equipment consists of three horizontal four-cylinder, triple-expansion Franco Tosi engines, having one high, one intermediate and two low-pressure cylinders. Each has a capacity of 2,600 horsepower and is equipped with Lentz valve gearing.

The direct-connected, three-phase generators are of the British Westinghouse make and have a capacity of 1,800 kilovolt-amperes, making 93.7 revolutions per minute and developing 6,000 volts at fifty cycles. Exciting current is furnished from a common set of buses by two 130-kilowatt, 125-volt, six-pole generators, one being driven by a vertical two-cylinder Delaunay-Belleville engine and the other by a 190-horsepower induction motor supplied with three-phase, 220-volt, fifty-cycle current.

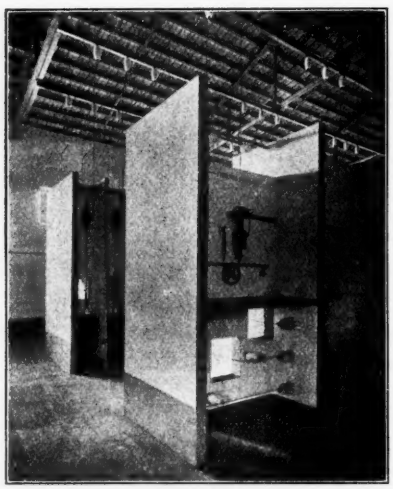
For long-distance transmission the 6,000-volt generator potential is stepped up to 33,000 volts. The equipment of transformers and other high-tension apparatus is among the most interesting features and has been installed by the Maschinenfabrik Oerlikon of Switzerland.

In the accompanying wiring diagram it will be noticed that the ultimate equipment will be seven main generator units, and that the present five main outgoing feeders are arranged symmetrically to the former. Current may be thrown on the 6,000-volt bus-bars or on the transform-



CASTELNUOVO-VALDARNO PLANT—600-KILOVOLT-AMPERE, 6,000-33,000-VOLT, FORCED-DRAFT-COOLED TRANSFORMERS.

ers direct. The current for the mines and auxiliary motors installed in the power plant is drawn from the generator bus. Auxiliary 6,000-volt buses feed the transformers supplying 220 volts to these various motors. The exciter bus will be supplemented in the future by the storage battery indicated.



CASTELNUOVO-VALDARNO PLANT—ELECTROMAGNETIC SWITCH AND AUXILIARY BUS FOR GROUND TESTING.

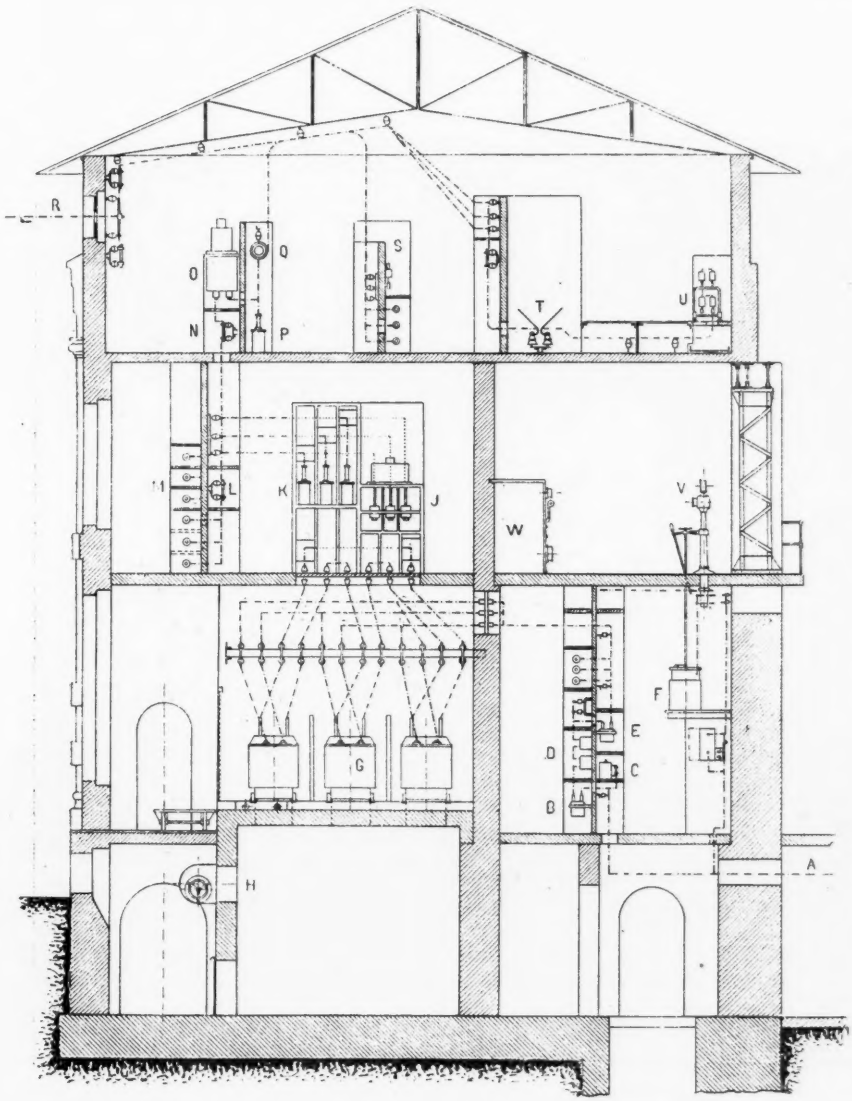
The 33,000-volt bus is of the ring system, frequently found in continental practice. One thing especially noticeable is

the number of sectionalizing switches employed, there being no less than fifteen to accommodate five outgoing feeders. By this scheme each transmission line may be fed by a generator, and in case of necessity may draw from any other generator, or the whole may operate in parallel.

In order to divide the whole bus and operate it in two distinct parts each end is provided with series and potential transformers, a voltmeter, three ammeters and one recording polyphase wattmeter.

The switch house possesses many novel features and is one of the most up to date in European practice. This house has, besides the basement, three main floors, which are divided longitudinally by a main partition wall, separating the two lower floors into high and low-tension divisions.

The 6,000-volt generator switch compartments are located on the main floor nearest the generators. Behind them and on the other side of the partition wall are the 6,000-33,000-volt transformer compartments, and above these are the 33,000-volt oil switches and bus-bars. In front of the latter and above the 6,000-volt switch compartments is the controlling room for the generators and high-tension feeders. The upper floor is similarly divided. Above the control room are the protecting devices for the outgoing lines, while in the middle is the ground-detecting equipment, and on the other side are automatic circuit-breakers, choke coils, etc., for the outgoing feeders.



CASTELNUOVO-VALDARNO PLANT—CROSS-SECTION OF SWITCH HOUSE.

A—Generator leads; B—Automatic overload oil-switch, 6,000 volts; C—Potential transformer; D—Series transformer; E—Selector switch; F—Generator rheostat; G—Transformers; H—Blowers; J—Automatic overload oil-switch, 33,000 volts; K—Series transformer, 33,000 volts; L—Hook switch; M—Busbars, 33,000 volts; N—Hook switch; O—Automatic overload feeder oil-switch; P—Series transformer; Q—Choke coils; R—Outgoing line; S—Ground-detector equipment; T—Horn gaps; U—Water rheostats; V—Instrument column; W—Switchboard.

The generator leads are bare conductors carried on ribbed insulators and run to the switch compartments, which are made of reinforced concrete. Each contains a potential transformer for the voltmeter, two for the potential coils of the reverse current relay and polyphase wattmeter, and two remote-controlled oil-switches for throwing the generator on the bus or directly on the transformers.

On the back of each switch compartment is an automatic oil circuit-breaker with a time limit and reverse-current relay, a series transformer for an ammeter, two for the relays and two for the polyphase wattmeter. Referring to the cross-section of the switch house, the arrangement of the switch compartments is indicated by the letters B, C, D and E. Opposite these compartments are the field rheostats located on a shelf indicated by F. They are actuated from instrument columns, V.

The generator instrument columns are arranged in groups of three, between which and in the middle of the gallery are located the columns for controlling the exciters. Upon each generator column are mounted one ammeter for the generator and one for the exciter current, a double voltmeter, a polyphase wattmeter and two pilot lamps for the overload switch. There are also three levers, one for the overload and two for the selector switches.

Provision is made by means of a mechanical interlock located between the generator and selector switches, so that when the generator is to be thrown in for parallel operation one of the selector switches must be closed before the main switch, and on the other hand the main switch must be opened before the selector switches.

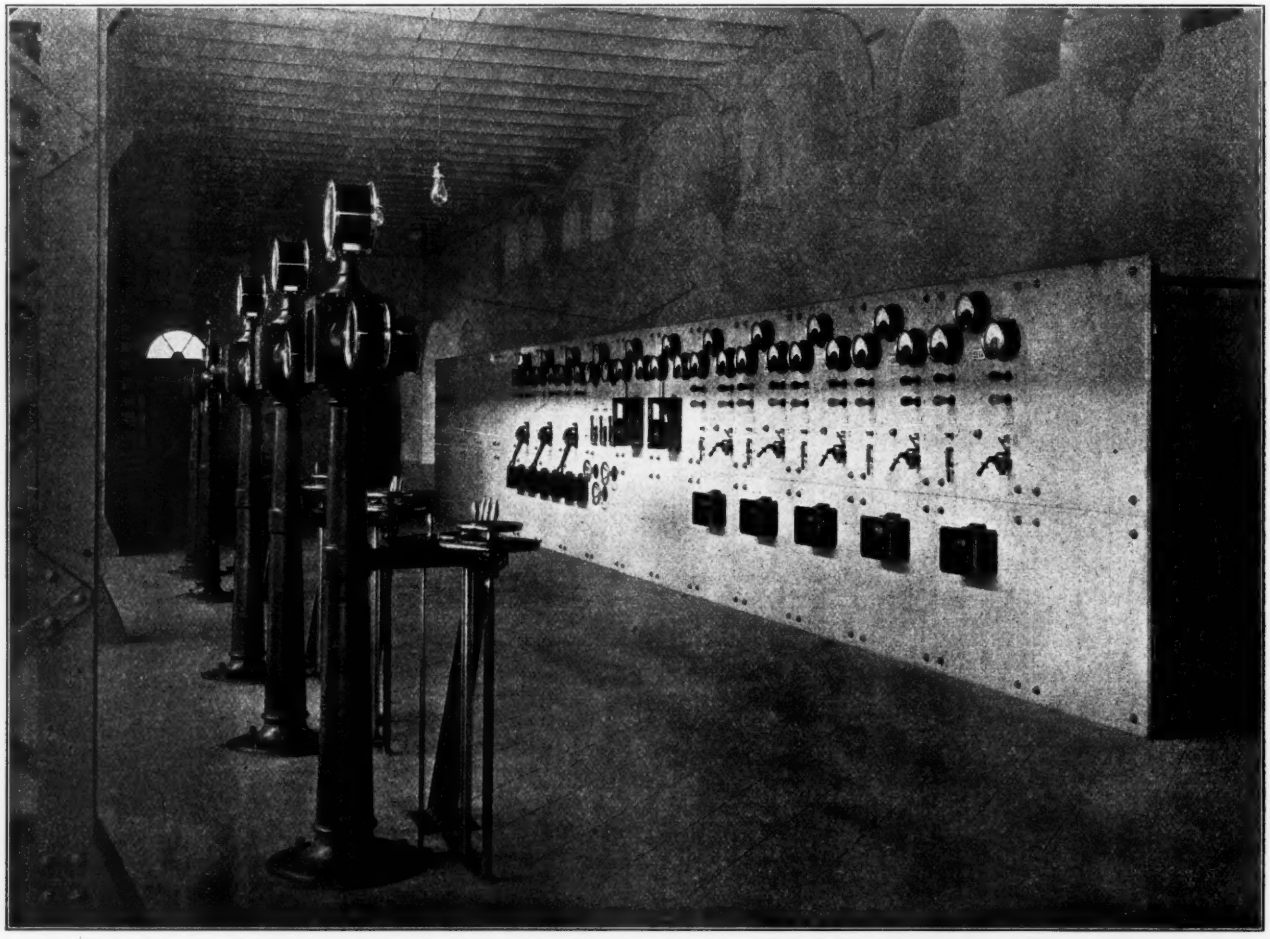
The exciter current is controlled by two-point carbon switches, operated from the instrument columns by worm gearing. The rheostat for regulating the field of each main generator has two successive contact devices, for which two handwheels are provided on the instrument column. The excitation and main generator switches are so interlocked that the latter cannot be closed when the former is open; on the other hand, the field switch cannot be opened before the main switch. Synchronizing is facilitated by means of a double voltmeter and voltmeter selector switch, so that the voltage and phase of

an incoming machine can be compared with those in operation.

Of the two exciter columns, one serves for a future storage battery and the other is provided for each machine with an ammeter, a voltmeter, a handwheel for the automatic overload switch and one for the exciter field rheostat. There are also signal lamps and a starting device for the induction motor.

The transformers are arranged contrary to the usual practice, in groups of three compartment, or three transformers) suspended from a wall of the air chamber in the basement. A novel feature of these transformers is that the core is not surrounded by a casing, but instead the lower half only is surrounded by glass plates.

There are seven compartments for the accommodation of twenty-one transformers, nine of which are at present installed. Another compartment contains four open, air-cooled 6,000-220-volt transformers, each of 250 kilovolt-ampere capacity. pole time-limit relays, are actuated from the controlling board by means of levers, cables and bell cranks. Each transformer group has its own panel on the main control board. Each panel contains a lever for the automatic oil-switch, three ammeters, two signal lamps for indicating the position of the switch, together with a two-pole overload time-limit relay and a two-pole overload reverse-current relay for the generator which belongs to the group.



CASTELNUOVO-VALDARNO PLANT—SWITCHBOARD AND CONTROLLING GALLERY.

in a common compartment, in which they are separated from one another by concrete slabs 6.5 feet high. The ends of the compartments open into a common corridor and are provided with corrugated-iron swinging doors. By means of casters on the transformers they can be moved onto a small truck in the side aisles and the whole conveyed to the repair room.

All the transformers are of the Oerlikon single-phase, air-cooled, open-core-type, connected in delta. Each has a capacity of 600 kilovolt-amperes. The air is supplied to the transformers by means of motor-driven blowers (one for each These serve for the operation of the exciter group and motor pumps for condensing and boiler-feed purposes, as well as for lighting the station. Three of these transformers have their primaries connected in delta and the secondaries in star. The fourth is kept in reserve, and by means of hook switches it is readily cut in.

Instead of being connected in the transformer compartment the high-tension leads run to the floor above, where they are connected in delta, joining here the oil-switches and then the bus-bars. These oil-switches, provided with two-

The feeder automatic oil-switches are provided with overload time relays and are electromagnetically operated from the main control board. Each can be isolated on either side by hook switches. The current passes three series transformers for the ammeters and relays, then through a choke coil and finally through a hook switch out onto the line. Passing under the outlet for each feeder is a common ground bus, which by means of a hook switch is easily connected to each circuit. This arrangement was thought necessary because a number of the substations have synchronous motor-generator sets with

storage batteries, and as the sets may sometimes be inverted, being fed by the batteries, there is the possibility that the synchronous motor will feed back into the line.

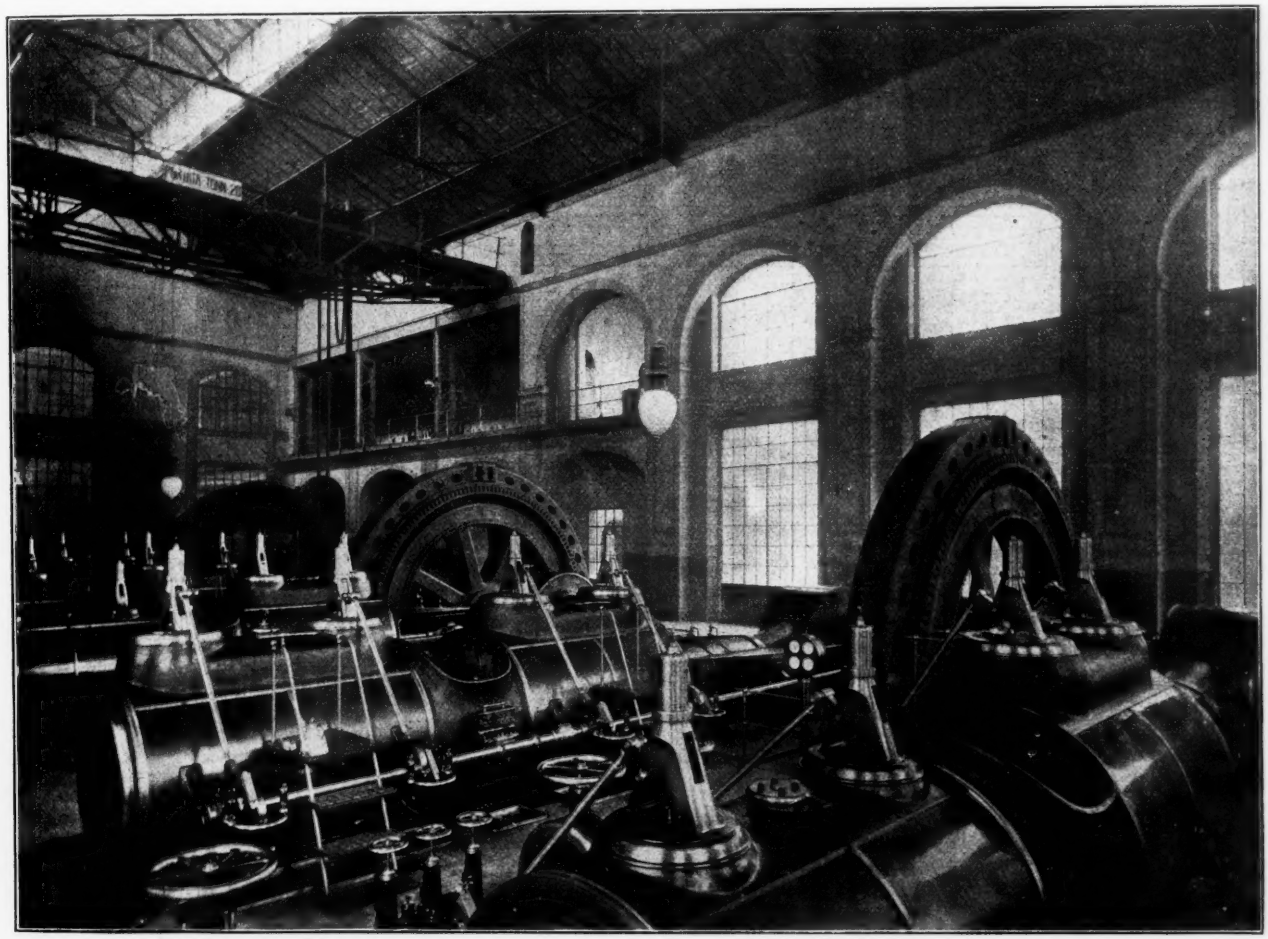
The outgoing circuits are well protected against lightning and other atmospheric discharges. To take care of direct lightning strokes each phase is provided with a horn gap connected in series with four tile water rheostats. The lighter discharges are led off by the Oerlikon water-flow grounders, much used in Swiss and Italian high-tension practice.

There is a very elaborate system for testing the lines for insulation and grounds. It consists of separate auxiliary bus-bars, high-tension oil switches, etc., so arranged that not only can the individual circuits be tested separately, but the phases of the circuits can be tested independently. An electric lock prevents more than one phase from being tested at a time. By means of this equipment the exact location of a ground on a line is readily determined. The method of procedure is as follows: When a grounded line is thrown on the auxiliary bus the ohmmeters give a certain indication. An artificial line is then built up in the station using dry cells. After a few trials the required number of cells to give the same deflection on the ohmmeter as did the line is obtained. As the resistance and other factors of the artificial line bear a certain ratio to the same conditions of the main line, by checking up the elements of the Siemens dry batteries and other factors and multiplying by the ratio the precise location of the trouble is determined.

A separate panel on the main switchboard is set aside for the ground-testing instruments, consisting of three ohmmeters, three single-pole switches for cutting in a battery of seventy-eight Siemens dry cells and a handwheel to facilitate making adjustments.

Each panel for the outgoing lines contains three ammeters, a control switch with two pilot lamps for governing the oil-switches and two-pole time-limit relay, and a control switch with pilot lamps for ground tests. Thorough precautions for safety have been taken. All non-current carrying exposed metal parts, such as brackets carrying insulators, etc., are grounded.

There are at present installed five 33,000-volt transmission lines. One line to Florence is 15.6 miles long; parallel to the same and continuing past Florence is a circuit 30.6 miles long to Prato. Just outside of Florence is a switching station whereby the two lines can be run in parallel as far as the latter city. One line runs southward 16.75 miles to Siena. Another line goes to the iron works at San Giovanni, 3.6 miles distant. Parallel to this and branching off near the substation at San Giovanni runs a circuit six miles long to Figline.



CASTELNUOVO-VALDARNO PLANT—INTERIOR OF GENERATING ROOM.

The transmission towers are of steel lattice construction; the lowest insulator is about forty-five feet from the ground. They are set in concrete blocks which are about six feet deep. The insulators are of the three-piece, triple-petticoat type with a porcelain base, the total being about ten inches high. The head is about nine inches in diameter. They are

mounted on wooden brackets with a spacing of thirty inches between the conductors.

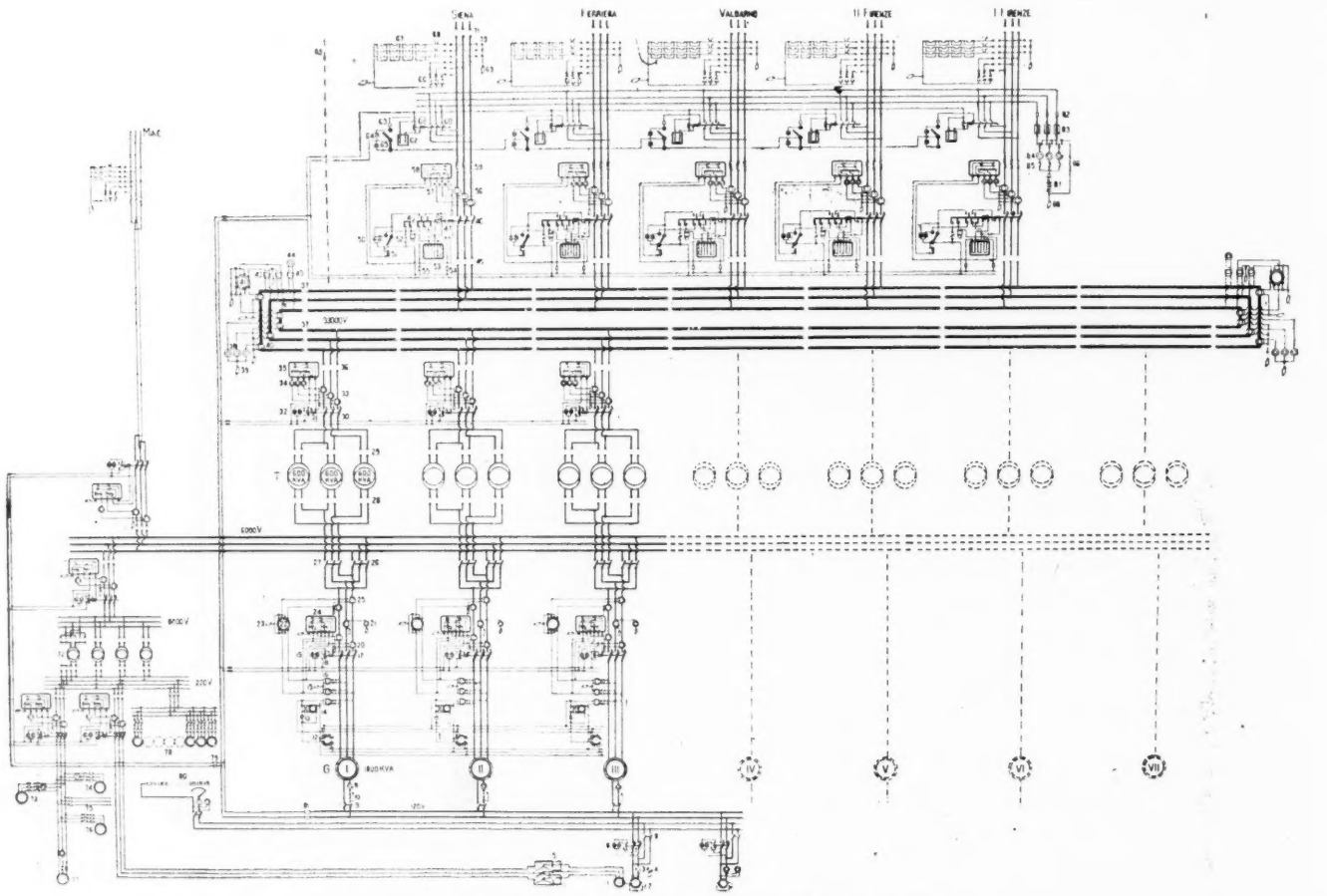
In the substation at Florence are installed four 300-kilovolt-ampere, single-phase transformers (one being kept in reserve) to step down from 31,000 to 5,200 volts. The substation has been designed to accommodate twelve transformers. There are also installed two three-phase, fifty-kilovolt-ampere transformers to step down from 5,200 to 260 volts.

The substation at Prato has been designed to accommodate six 300-kilovolt-ampere, single-phase transformers; four of these are at present installed, one being kept in reserve. There are also two fifty-kilovolt-ampere, three-phase transformers. The former step down from 30,000 to 5,000 volts, the latter from 5,000 to 300.

At Siena the substation is designed to accommodate six 300-kilovolt-ampere single-phase transformers, three of which are at present installed.

At the ironworks in San Giovanni there are six 300-kilovolt-ampere, 32,000-3,000-volt, single-phase, oil-insulated, water-cooled transformers. Provision is made for twice as many. At Figline there is but one oil-cooled, 125-kilovolt-ampere, 31,000-3,000-volt transformer.

All these transformers are of the Oerlikon make, and, with the exception of those installed in the last two stations, are of the forced-air-cooled type.



WIRING DIAGRAM OF CASTELNUOVO-VALDARNO PLANT.

1—Three-phase asynchronous motor; 2—D. C. generator for excitation; 4—Ammeter and voltmeter for exciter; 5—Starting device for three-phase motor; 6—Signal lamps; 7—Automatic overload switch; 8—Double-throw switch for storage battery; 9—Switch for exciter current; 10—Generator field rheostat; 11—Ammeter for exciter current; 12—Three-phase voltmeter switch; 13—Phase lamps; 14—Double voltmeter; 15—Ground; 16—Potential transformer; 17—Automatic overload switch (6,000 volts); 18—Reverse-current switch; 19—Signal lamps for above; 20—Series transformer; 21—Ammeter for generator current; 22—Double wattmeter; 23—Ground; 24—Maximum and reverse-current relay; 25—Current transformer; 26—Oil-switch; 27—Oil-switch; 28—Hook switch; 29—Hook switch; 30—Automatic circuit-breakers (33,000 volts); 31—Blow-out coil for above; 32—Signal lamps; 33—Series transformer; 34—Ammeter; 35—Overload time relay; 36—Hook switches; 37—Hook switches; 38—Bus ammeter; 39—Ground; 40—Current transformer; 41—Doube-recording wattmeter; 42—Potential transformer; 43—Potential transformer; 44—General voltmeter; 45—Hook switch; 46—Automatic oil circuit-breaker remote controlled; 47—Tripping magnet; 48—Closing magnet; 49—Double-throw trip indicator switch; 50—Signal lamps; 51—Pilot switch; 52—Switch for annunciator; 53—Rheostat; 54—Fuses; 55—Fuses; 56—Current transformer; 57—Feeder ammeter; 58—Overload time relay; 59—Choke coils; 60—Multiple switch for ground detectors; 61—Closing magnet; 62—Preventive resistance; 63—Fuses; 64—Signal lamps; 65—Pilot switch; 66—Water-flow grounders; 67—Water rheostat; 68—Horn lightning-arrester; 69—Ground; 70—Hook switch; 71—Hook switch; 72—Transformers for auxiliary motors; 73-77—Various auxiliary motors; 78—Ventilator motors; 79—Fuses; 80—Storage battery; 81—Fuses; 82—High-tension fuses; 83—Choke coils; 84—Ohmmeter; 85—Switch; 86—Shunt resistance; 87—Dry battery; 88—Ground; Ground testing equipment; 89—Future transmission line connection.

Third Rail for Pennsylvania Tunnel.

The Pennsylvania Railroad Company has announced that it has adopted the direct-current system of electric traction, generally known as the "third rail," for its New York and Long Island tunnel extension. This system of electric traction is now in use on the lines of the Long Island Railroad, with which lines the tunnel extension will be directly connected, and with which it is expected to facilitate suburban development in Long Island and New Jersey.

SMOKELESS COMBUSTION.

BY CHARLES L. HUBBARD.

(Concluded.)

From both an economical and a smoke-suppressing standpoint there are three generally recognized methods for hand stoking a boiler furnace to produce the best results. These are commonly known as "coke firing," "alternate firing" and "spread firing," and have been described in some detail by the writer in a previous article.

Some bituminous coals have little or no coking quality, but will fall into a more or less loose powdery form. Such coal will stand but little moving about on the grate after it has once been charged into the furnace. Other coal when heated will swell up and fuse into a pasty mass, forming a crust on top of the firebed, but after the volatile matter has been distilled from the coal the coke can be easily broken up and moved to any desired position on the grate. Sometimes two such coals can be mixed in such proportion as to give better results than either alone.

Coke firing is best applied to furnaces in which the gases pass over a bridge-wall at the rear of the furnace, or where a brick arch is provided, extending over the firebed for some distance toward the rear. In charging fresh coal into the furnace it is piled inside the door instead of being thrown directly upon the fire, and may occupy about one-third of the length of the grate, extending across the full width. The heat of the furnace will cause a slow distillation of the volatile matter from the coal, and these hydrocarbon gases passing over the incandescent bed of coke in the presence of an abundant supply of highly heated air will be completely consumed. When most of the volatile gases have been distilled from the coal the newly formed coke may be pushed back upon the grate, thus forming a new bed of practically smokeless fuel, and a supply of fresh coal may then be fired in the same manner as before.

After the fireman once becomes familiar with this method of firing in a properly constructed furnace he will be able to secure practically smokeless combustion with no greater difficulty than in the case of any rational system of firing. The economy of this method will vary in different cases, but in nearly every instance will show a saving in fuel. The disadvantages are the length of time it is necessary to keep the fire doors open for charging and cleaning, which allows a large quantity of cold air to rush into the furnace, not only checking combustion but also cooling the boiler parts and causing severe strains. These objections are overcome in various ways as will be described later.

In alternate firing the coal is placed on one side of the furnace at a time, and the result is somewhat like that obtained in the coking system, the gases being burned over the bright side of the firebed as they are given off. After the freshly fired coal has been changed to coke and is burning brightly without smoke the other side of the grate may be fired.

In spread firing fuel should be added at regular intervals, only one or two shovelfuls at a time, and each put where it is most needed. If there are two doors to a furnace, only one should be fired at a time. In other words, fire lightly and frequently. If the work is light and the draft good, smoke may be almost entirely prevented in this way. If the work becomes heavier, fire oftener but do not put on more than three shovelfuls at a time. If much smoke is noticed just after firing, leaving the furnace door ajar an inch or so for about a minute will prevent this.

Having described some of the more important points to be noted in hand firing, let us now consider some of the devices which can be applied to boilers already set without too radical changes.

One of the simplest of these is the steam jet for use when fresh coal is first charged into the furnace. This may be used with the ordinary flat grate and is of great assistance in preventing smoke and promoting combustion generally. The steam jet alone is of very little value, and should always be used in connection with some form of air supply over the fire, as the real benefit derived is not from the steam itself but from the artificial draft which it produces. Immediately after firing, more air is needed than can readily pass through the grate, and if this additional demand is not at once provided the fuel will smoke. If there are two or more steam jets over the furnace door, pointing downward toward the rear of the grate, and suitable air inlets in front or at the side of the grate, the opening of the steam jet will induce a draft and supply the needed air. The supply of steam and air should be gradually shut off as the fresh coal becomes coked. In some patented steam jets or blowers the arrangement is such that the air is drawn in through the blower itself by means of suitable openings provided for this purpose.

The value of any device of this kind depends upon the care which it receives. If of good design and properly used, it should prevent a large proportion of the smoke and at the same time increase the economy somewhat. But if the air-ways become clogged or the tips of the jets are allowed to burn off, or the fireman neglects to turn on steam, the device becomes useless. In order to overcome these objections to some extent, automatic means are often provided, one of which consists of a dashpot which is pushed up by opening the fire door. This in turn opens the valve on the steam jets, opens a hinged flap in the furnace door to admit air over the fire, and closes a check draft in the uptake to increase the draft. As soon as the door is closed the dashpot piston begins to fall and reverses these operations. The time of the falling of the piston may be regulated according to the amount of air needed by the particular kind of coal used. There are several devices working upon the same principle, but differing more or less in detail. It is claimed by some that a steam jet is injurious to the grates and boiler plates; but if the steam and air are well distributed there should be no danger of local injury. The amount of steam used need not be large, as it is only required intermittently, that is, when fresh coal is fired.

The furnaces mentioned thus far have been fired by hand and depend largely for their success upon the skill and faithfulness of the fireman. Briefly, the directions given may be summed up as follows: Keep the fires clean and bright and do not allow the grates to become clogged; carry as thin a fire as is sufficient for the work to be done, but do not allow air-holes to form; put on coal in small quantities (unless the coking system is employed) and as often as may be necessary, spreading it thinly and evenly, so that it may burn brightly at once; in cleaning do not tear the fire to pieces and uncover large spaces of grate, but clean one side at a time and cover the grate with red-hot fuel before putting on fresh coal; keep all flues and heating surfaces clean, and when firing heavily leave the doors slightly ajar for a couple of minutes or so after firing.

If, after improving the conditions by more skillful firing, it is desired to take a more radical step toward the elimination of smoke, one of the reliable forms of automatic stoker should be installed,

which, with proper care and adjustment, should be able to furnish steam to the full capacity of the boiler without an objectionable amount of smoke. The reason for their superiority over hand firing depends principally upon their uniform action and the avoidance of opening the fire doors for the introduction of fuel. The stoker feeds the coal to the fire regularly instead of intermittently, and the air supply can be easily graduated to correspond. When a stoker produces smoke regularly it is usually due to the fuel not feeding forward properly, and to its clogging and sticking to the bars. Either the stoker, the fuel or the fireman may be at fault for this condition: the stoker by improper shape and setting of its grate, the fuel by melting and forming clinkers, and the fireman by not adjusting the stoker to the fuel used.

Mechanical stokers may be divided into three general classes, as follows: Those with rocking or shaking bars placed in an inclined position, traveling or chain grates, and under-feed stokers.

The first type is unsuitable for burning a coking coal, the only satisfactory fuel in this case being one which burns freely, forming a light ash and little clinker. Stokers with inclined grates have not always given the best satisfaction as smoke preventers on account of the fuel sticking to the top of the grate and leaving holes in the fire below. This makes it necessary to poke the fire from time to time, which is liable to result in rolling considerable masses of burning fuel to the bottom of the grate, and carrying more or less unburned coal with it.

Chain-grate stokers are particularly well adapted to large plants carrying a uniform load, and have the advantage of being self-cleaning and are very efficient in the prevention of smoke. They usually consist of an endless chain having a width equal to that of the furnace, running over sprocket wheels at the front and rear. The coal is fed onto the grate at the front and the ash is dumped over the rear end.

Under-feed stokers rank next to chain-grates in the prevention of smoke, being practically smokeless except at the times of cleaning the fire or when the side doors are open.

In addition to mechanical stokers, there are several furnaces of special design which give very good results. One of the most successful in smoke prevention and economy is the so-called down-draft furnace, which is built on the principle of a kerosene lamp. The coal in this furnace burns from the bottom, that is, the flame is led away from the fuel just as with a candle or lamp.

The gases are thus distilled slowly and afforded an opportunity to come in contact and mingle with the proper amount of heated air. The upper grates supporting the fire must, of course, be water grates, otherwise they would be burned. Below the water grate is a common grate for catching and burning the coke which falls through the upper grate when the fire is sliced. In this furnace the excess of heated air which passes through the lower grate is necessary for complete combustion of the hydrocarbons which may pass through the water grate with a deficient amount of air. With this form of furnace an almost entirely smokeless chimney and a considerable gain in economy can be obtained if handled with a reasonable amount of intelligence.

Another form of special furnace has a grate made up of two parts, the forward part being stationary and sloping moderately from the fire doors toward the dumping grate at the rear. A fire-brick arch is built across the center of the furnace over the rear grate. Fuel is fired upon the front or sloping grate and after the gases have been given off it is pushed back upon the dumping grate. Air is admitted through both grates from the ash-pit and also above the fire through a special opening in the front wall. The arch serves to deflect the air and gases downward toward the incandescent coke upon the dumping grate, which insures complete and smokeless combustion if proper care is used in firing.

Another form differs from the ordinary furnace in having two vertical walls, with a narrow opening between them, built back of the bridge wall near the end of the boiler. In addition to these, there is a fire-brick arch over the combustion chamber and a series of short walls or piers back of the bridge wall. Coal is fired alternately upon one-half of the grate at a time and the smoky gases from the freshly fired side and the excess of very hot air passing through the bed of bright coal on the other side are brought together by passing through the narrow opening between the two vertical walls, and combustion is therefore made much more complete.

One important matter in the design of a furnace for smokeless combustion is to obtain the proper area of grate surface to burn the fuel used to the best advantage. First, the particular kind of coal to be used should be selected, and then the rate of combustion determined. This will vary for different coals. A writer in *The Engineer* gives the following, based upon a series of tests, as giving average results:

Kind of Coal.		Pounds Burned per Square Foot of Grate per Hour.
Anthracite	Steam sizes	15
Semi-anthracite	Steam sizes	16
Semi-bituminous		18
Eastern bituminous		20
Western bituminous		30

It is an important matter to have the grate bars properly spaced to give room for the air to pass to the fuel bed and combustion chamber beyond it. If an excessive amount of ash occurs in the fuel used, shaking grates should be used (if hand fired), so as to easily keep the air openings clear, and thus facilitate the passage of air through the grates and fuel.

In drawing up smoke ordinances it is necessary to state what degree of density constitutes an offense. It will be found in practice that a certain latitude must be allowed, as there are usually periods of two or three minutes in the case of hand-fired boilers when smoke will be emitted from the chimney, and it is well in framing such an ordinance to state that smoke above a certain degree of density will not be permitted for periods of over a given length of time.

There are several ways of determining the density of smoke; the one most commonly used at present is known as the Ringelmann Chart. This is composed of six rectangles, the first being perfectly white, while the sixth is entirely black, and the intermediate rectangles placed between these two extremes have a series of black lines ruled upon them at fixed distances apart, as indicated below:

No.	Black Spaces.	White Spaces.
0	.....	All White
1	1 m. m. wide	9 m. m. wide
2	2.3 m. m. wide	7.7 m. m. wide
3	3.7 m. m. wide	6.3 m. m. wide
4	5.5 m. m. wide	4.5 m. m. wide
5	All Black.	.....

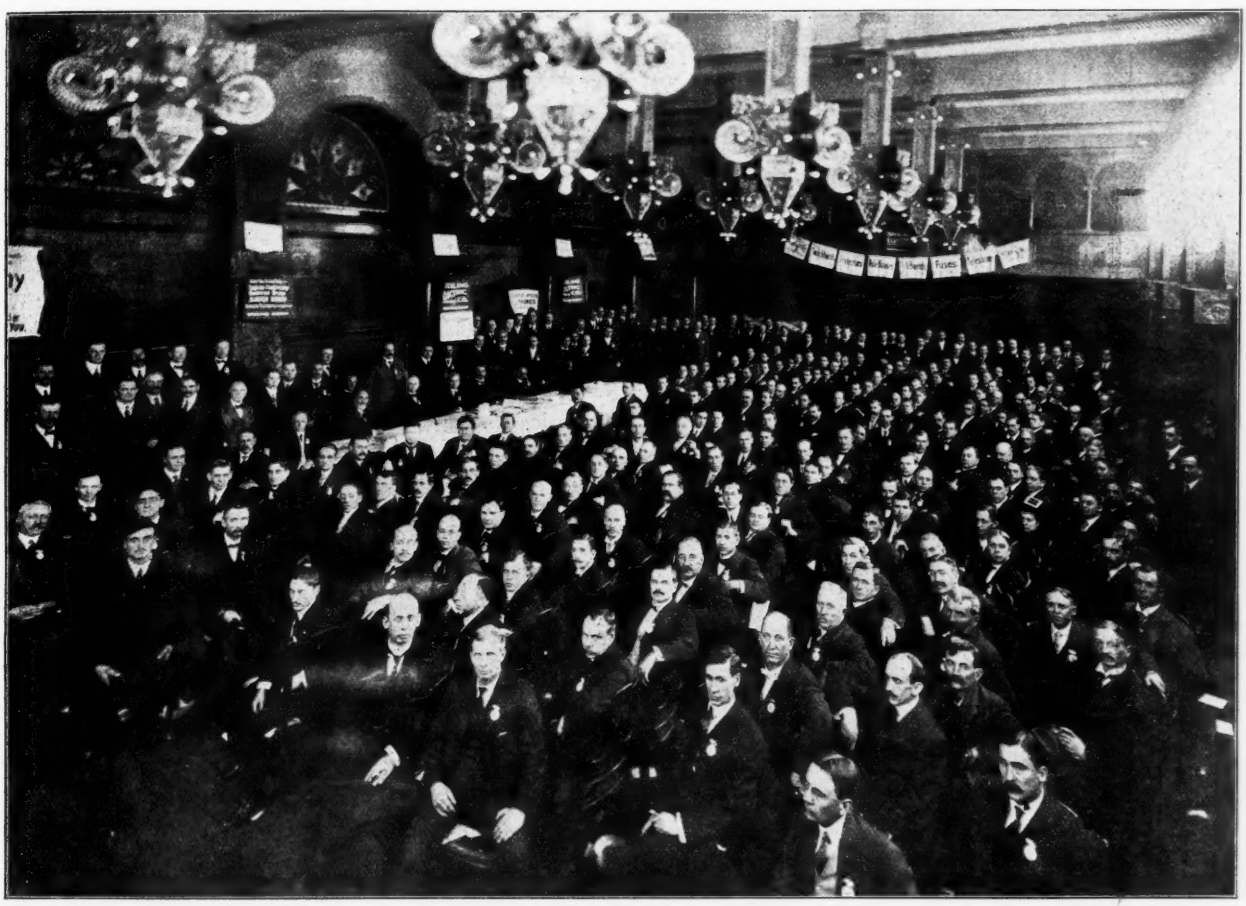
This chart is placed between the observer and the chimney, and at a distance of some fifty feet it will be seen that the ruled lines upon the rectangles are blended together to form a succession of tints, so that the observer may compare the tint of the chart with the gray or black smoke as it issues from the chimney.

In Australia a telegram is carried 3,000 miles at the rate of two cents a word across the territories of six governments and states.

INDEPENDENT TELEPHONE CONVENTION.

THE CLOSING SESSIONS—THE EXHIBITS.

The twelfth annual convention of the International Independent Telephone Association, held in Chicago during the week of December 1, was brought to a successful close after a belated session on Thursday afternoon, when the final business and election of officers was finally transacted. The convention was marked by lively interest and general attendance on the part of the delegates, representing "four million telephones and seventeen million users," and the manufacturers of Independent telephone apparatus were on hand with an instructive array of equipment and exhibts estimated at a total value of about $50,000.



ANNUAL CONVENTION OF THE INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION, AUDITORIUM HOTEL BANQUET HALL, CHICAGO, ILL., DECEMBER 2, 1908.

As reported in full in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of last week, the three sessions of Tuesday were given over to preliminary business and the consideration of certain important technical matters. On behalf of Mayor Busse, George M. Bagby, assistant corporation counsel for the city of Chicago, welcomed the members of the convention, and his cordial words were given a pointed response in the reply of R. D. Critchfield, president of the Wisconsin Telephone Associaton, who urged upon the city administration the importance of telephone connection with the large majority of Independent subscribers in the vicinity of Chicago.

Tuesday afternoon was devoted to technical discussion relating to local line operation. Roy Owens, of Columbus, Ohio, presented a paper on "The Telephone Engineer in His Relation to the Telephone Business." J. H. Ainsworth, of Dayton, Ohio, discussed "Some Economies in Handling Maintenance Men." G. E. Bickley, of Waterloo, Ia., read a brief paper on "Maintenance Economies." J. P. Boylan's paper on "Handling Trouble" was read by B. H. Brooks.

At the evening session matters of interest to toll-line operators were taken up. Frank F. Fowle, consulting engineer, Chicago, delivered, in abstract, his exhaustive paper on "The Economical Development of Toll Territory." George K. Gann, Lincoln, Neb., related in brief the contents of his paper, "Handling Long Distance Traffic." Both afternoon and evening technical discussions were in charge of Gansey R. Johnson, of Columbus, Ohio.

The early part of the session of Wednesday morning was given over to the reading of the reports of various state and local Independent telephone associations, affording a favorable account of the progress of the Independent movement throughout the country. The convention then listened to the paper on "The Supply and Preservation of Poles," by W. F. Sherfesse, an expert in the employ of the Forest Service.

Mr. Sherfesse spoke of the relative advantages of the preservatives used in the prevention of the decay of wood. These are corrosive sublimate, copper sulphate, zinc chloride and creosote. The first two are being supplanted by the latter in the preservation of telephone-line material. Zinc chloride may be painted over, but has the disadvantage of being soluble and will bleach out of the wood. Creosote has a higher first cost and possesses the

added disadvantage of a rather limited supply.

The preservative treatment of impregnation may be carried out in the presence of either artificial or natural pressure. The pressure treatment involves first subjecting the wood to a steam bath, then exposing it to a partial vacuum, to exhaust the moisture and air from the pores and cellular interstices, and finally applying oil under pressure. This treatment is giving way to the "open-tank" treatment of the butt, which requires less expensive apparatus and is simpler to effect. Air-dry wood is placed in an open bath of hot oil. The oil is then cooled, or run out and its place taken by cold oil, or the wood is removed and plunged into a receptacle containing cool oil. The preserving compound penetrates the sapwood easily, but longer duration of the treatment is required for its effective entrance into the heartwood.

The benefits of the preservation treatment are manifested by the increased life given to the ordinary run of timber, and the possibility of use of a cheaper grade of wood otherwise entirely unsuitable. Thus, southern loblolly pine can be treated and made useful for telephone purposes, and fire and insect-killed timber becomes as available as that thoroughly seasoned.

Business and financial matters of Independent telephone operation were discussed during the session of Wednesday afternoon. "Damage Suits—Their Prevention and Defense" was the subject of a paper by William S. Hart, an attorney of Waukon, Ia. C. E. Wilson, of Philadelphia, Pa., read a paper on "Pernicious Political Pull" and J. B. Hoge, Cleveland, Ohio, presented the matter of "Insurance—Liability and Fire."

The programme of the afternoon session was interrupted by the committee on finance, which issued a call for funds to carry on the campaign of education and legal enactment in the interest of the Independent telephone movement. Following the call, the convention scene was an enthusiastic one as the delegates rose in quick succession to pledge duplication of the subscriptions of state associations, companies and individuals for the year before, or to increase or propose new amounts. Under the active invitations of James S. Brailey, Jr., chairman of the finance committee, in an incredibly short time the total amount subscribed reached $95,000.

At the annual association banquet, held at the Auditorium Hotel in the evening, the following toast list was given, with Dwight E. Sapp of Mt. Vernon, Ohio, presiding at the speakers' table:

"The Telephone President." H. D. Critchfield, Milwaukee, Wis.

"The Crowning Triumph." W. S. Hart, Waukon, Ia.

"Mergers and Alliances." D. J. Cable, Lima, Ohio.

"Competition versus Monopoly." Judge C. W. Showalter, Parkersburg, W. Va.

"The Telephone and the Law." Clarence Browne, Toledo, Ohio.

"Our Emblem." Manford Savage, Champaign, Ill.

On Thursday morning, following the reading of the reports of the remaining state and local associations, Secretary Ware read the paper on "A Sound Financial Policy," by E. B. Fisher, Grand Rapids, Mich.

"Some Telephone Problems" was the title of a paper by Morgan Brooks, professor of electrical engineering at the University of Illinois, which received the interested attention of the convention.

Success in the telephone field has been due to the engineer rather than the inventor, premised the writer. He then directed attention to the priority of use of the telephone induction coil over the transformer for the transmission of electric currents to great distances. Professor Brooks reviewed briefly a number of problems of construction, the matter of "loading" long lines, and the increasing danger and annoyance from high-tension power lines near telephone circuits. The advent of the single-phase alternating-current railway has brought in a large share of troubles which simple expedients of transposing or insulating the telephone line have been unable to remedy. A three-phase high-tension power transmission system carrying a balanced load creates only a slight disturbance, since the wires are comparatively close and the sum of the currents in any two wires at any instant is equal to that in the third. However, the single-phase railway employing a single conductor of comparatively high voltage (3,300 to 6,600 volts) with a ground return, introduces conditions of noise and even dangerous induced potentials which cannot be well avoided without removal of the telephone wires outside of the disturbing zone.

The engineering experiment station of the University of Illinois, said Professor Brooks, is now building an experimental line, paralleled by power wires, one mile in length, and arranged so that any required conditions can be obtained. That actual danger exists to men working a telephone line near a high-tension circuit, Professor Brooks cited a laboratory experiment in which an insulated wire five feet away from a 6,000-volt line showed an induced potential of 500 volts. While this represented only the slight static charge of the line, the capacity of the wire being, of course, very small, the professor believed that a long line under certain conditions might deliver a fatal current. The improving insulation of telephone lines of course tends to conserve the charge, and with improved conditions in this direction the danger from induced shocks is increasing. A telephone line within 200 or 300 feet of a single-phase trolley line will likely be rendered inoperative, and the effect of the alternations has been noticed at a distance of several miles.

Following Professor Brooks' discussion of high-tension alternating-current sources of annoyance and danger, Secretary Ware read a paper on "Western Electric versus Independent Telephone Apparatus."

At the afternoon session a number of committee reports were heard and before the convention was finally declared adjourned the following officers were elected: President, E. H. Moulton, Minnesota; first vice-president, P. C. Holdoegel, Iowa; second vice-president, E. B. Fisher, Michigan; treasurer, Manford Savage, Champaign, Ill.; secretary, A. C. Davis, West Virginia.

Directors for one year: A. E. Boqua, Arkansas; J. W. Barnes, West Virginia; M. L. Colladay, Missouri; P. H. Griswold, New York, and A. E. Yaxlor, Illinois. For two years: F. D. Houck, Pennsylvania; Frank C. Hoge, Kentucky; W. H. Nelson, Kansas; Dr. J. E. Demers, Canada, and H. D. Critchfield, Wisconsin. For three years: Frank L. Beam, Ohio; Manford Savage, Illinois; James H. Shoemaker, Iowa; Charles B. Norton, Indiana, and E. B. Fisher, Michigan.

The next convention will be held in Chicago in December, 1909.

A direct outcome of the Independent telephone convention in Chicago is the amiable consideration given by the city administration to the matter of long-distance connection with the large proportion of Independent subscribers in the adjoined states.

A committee from the telephone association held a conference with the council committee on gas, oil and electric light,

which resulted in the association being requested to submit a concrete proposition at an early date.

A. C. Lindemuth of Chicago went into details regarding the proposed service before the council committee, and in reply from queries from Aldermen Pringle and Snow, gave data regarding the operations of the Bell company. The committee for the telephone association was told that a local service might not be considered at this time, but that a long-distance service, built along the lines proposed by Mr. Lindemuth, might be accepted by the council.

EXHIBITS AT THE TELEPHONE CONVENTION.

The North Electric Company, Cleveland, Ohio, presented one of the most interesting and novel of the exhibits in the shape of a section of the new Clement Automanual switchboard it has begun to install at Ashtabula, Ohio. The Automanual system, as the name implies, combines certain features of both the manual and automatic switchboards. As explained in a circular given out by the North company, any standard common-battery subscriber's instrument can be used in the new system, as the subscriber calls in the usual way, verbally, giving the number wanted to the operator, who sets it up on a keyboard similar in appearance to that of an adding machine. From this point the operation of selecting a trunk, connecting and ringing the called subscriber is all performed automatically. Immediately the operator has set up one call she is ready for another, and the calls are automatically distributed among the positions, the simple duty of the operators being to set up the numbers. Clearing-out is automatically effected by hanging up the receivers. Edward E. Clement, the inventor of the Automanual system, was present and answered the questions of a great many interested inquirers.

The Sandwich Pole-Changer Company, Sandwich, Ill., showed an operating exhibit of its product which is adapted to supply either alternating or pulsating current. The three contact springs are provided with heavy platinum contacts, and in other respects the Sandwich pole-changer is of extremely rigid and compact construction.

Stanley & Patterson, New York, N. Y., showed a number of sections of the Patterson wireless dry-battery holder, with the special form of dry cell adapted to fit in this convenient holder. One of these types of cell is provided with both the standard binding posts and the screw-thread contacts. The Patterson holder is made with an automatic bridge which restores the continuity of the circuit if any cell is removed.

The Everstick Anchor Company, St. Louis, Mo., showed a number of anchors made on its well-known mechanical principle, so arranged that after the anchor is inserted in an eight-inch hole it may be tamped to expand its plates out into the undisturbed earth.

The Miniature Telephone Booth Company, New York, N. Y., demonstrated two popular forms of its telephone container by the use of which one may secure the utmost privacy in the use of his instrument without actually entering a sound-proof box.

Middleton Bros., Monadnock Block, Chicago, gave practical demonstrations and instruction in the use of testing instruments for locating telephone troubles. The Universal test set was used in these demonstrations.

The Dayton Telephone Lock-out Manufacturing Company, Dayton, Ohio, exhibited the Kneisly-Billman lockout for use on party lines. The hook switches of any subscribers on the line, not called, are effectually locked down until released by the central operator with this system.

The Duplex Metals Company, New York, N. Y., had an interesting exhibit of Monnot copper-clad steel wire, which is manufactured in a variety of forms and sizes for telephone and electrical use. The two metals are welded with a perfect autogenous joint, and the wire combines with the strength of the steel the superior conducting and non-oxidizing properties of the copper covering.

The Baird Manufacturing Company, Chicago, showed its new Baird chronograph. Any number of toll tickets may be "started" in this machine and then "finished" in any order whatsoever, while the machine will print on each the actual duration of the call as well as the time and date.

The Holtzer-Cabot Company, Brookline, Boston, Mass., made a very complete demonstration of its new and leading products. One of these is its new four-frequency multicycle vibrating converter. Another is its composite multicycle motor-generator set. For use with these there is a frequency meter which operates on an escapement principle. A full line of pole-changers, switchboard and telephone parts made up the rest of the exhibit.

The Excelsior Supply Company, Chicago, exhibited two handsome Excelsior autocycles, which are coming to be used to an increasing extent by telephone men in going quickly to the scene of line and other trouble.

The Universal Specialty Company, Terre Haute, Ind., offered a few suggestions on the construction of telephone drop circuits by the use of its Universal insulators adapted to carry two wires.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., held the interest of the operators of magneto exchanges with its self-restoring gravity drop and magneto switchboards.

The Homer Roberts Telephone Company, Chicago, Ill., had a number of operating lines of its local-battery party-line system, on which calling is accomplished by lifting the receiver off the hook, as in a common-battery exchange. By an emergency arrangement the subscribers' signaling means is always available, whether his own or any other instrument is in use, so that the line cannot be effectually tied up by any subscriber.

The Illinois Electric Company, Chicago, made a feature of its exhibits of pole seats and circle tops. The latter is somewhat of an innovation in distributing circles, as the entire ring, twenty-one inches in diameter, is of gaspipe covered with circular loom.

The Indiana Steel and Wire Company, Muncie, Ind., exhibited its extra double-galvanized telephone and telegraph wire.

The Fibre Conduit Company, Orangeburg, N. Y., was represented by W. W. Smythe, Jr., western manager, and had on exhibit all sizes of the socket-joint type of Orangeburg fiber conduit as well as its thin-wall-type linaduct and distributing-pole bends and reducers. Sections of four-duct subway showing these products installed in concrete were also shown.

The Automatic Electric Company, Chicago, took the occasion of the Independent telephone convention to introduce its new dial-type of instrument as well as its small calling switch which can be applied to any common-battery set. The Automatic Company operated a complete exchange with a number of instruments equipped with automatic ringing, doing away with the necessity for the calling subscriber's pressing the button.

The American Electric Telephone Company, Chicago, showed a full complement of its line of switchboards, telephones and parts.

The Century Telephone Construction Company, Buffalo, N. Y., manufacturer

of switchboards, telephones and parts, occupied Room 628 with an exhibit.

The Chicago Telephone Supply Company, Elkhart, Ind., had rooms 420 to 426 inclusive for its exhibition of telephone apparatus.

The Cracraft-Leich Electric Company, Genoa, Ill., demonstrated the telephones and switchboards of its well-known make.

H. E. Cobb, Chicago, occupied a room on the parlor floor of the Auditorium Hotel with rubber-covered and galvanized wire, general supplies and protective devices.

Frank B. Cook, Chicago, showed some of the latest of his large line of telephone protective apparatus.

The Corwin Telephone Manufacturing Company, Chicago, exhibited intercommunicating switchboards.

W. H. Couch, Boston, Mass., showed a general line of telephone apparatus.

The Dean Electric Company, Elyria, Ohio, made a feature of its harmonic ringers in addition to its general exhibit of switchboard and telephone parts.

The Electric Appliance Company, Chicago, made an exposition of general telephone supplies.

The Fox & Borden Manufacturing Company, New York, N. Y., showed a number of telephone specialties in Room 647.

The H. S. Green Battery Company showed batteries.

Frederick Grier, president, and A. L. Hasse, sales manager, of the Harvard Electric Company, were in daily attendance at the convention.

J. Wiley, of the Standard Underground Cable Company, was a prominent figure among the manufacturers' representatives.

The Manhattan Electrical Supply Company, Chicago, exhibited small power devices.

The Miller Anchor Company, Norfolk, Ohio, demonstrated its expansible anchors for guying.

The Monarch Telephone Manufacturing Company, Chicago, exhibited telephone instruments and switchboards on the convention hall floor.

The Ohio Brass Company, Mansfield, Ohio, had an exhibit of line material.

The National Carbon Company, Cleveland, Ohio, interested the local-battery telephone men with its exhibit of dry cells.

F. W. Pardee, Chicago, showed batteries, wire, receiver shells and cable reels.

The Pierce Specialty Company, Elkhart, Ind., made an exhibit of telephone construction material.

The St. Louis Malleable Casting Company, St. Louis, Mo., showed a number of telephone specialties.

The Sterling Electric Company, Lafayette, Ind., occupied the hotel writing room with a diversified array of the apparatus of its manufacture and exhibited as a rather novel departure a compressed-air and vacuum cleaning system.

The Swedish-American Company, Chicago, showed a complete exhibit of telephones, switchboards and parts.

The Vote-Berger Company, La Crosse, Wis., demonstrated the simplified common-battery exchange circuits made possible by the use of its well-known ballasted lamp. In series with an iron ballast the lamp is placed directly in the line circuit, and on account of the temperature coefficient of the ballast the lamp will come to approximately the same brightness over a considerable range of impressed voltage.

The Warner Electric Company, Muncie, Ind., exhibited a complete line of the well-known Warner pole-changers.

The Westinghouse Machine Company, Pittsburg, Pa., exhibited storage cells of interest to common-battery men.

The Wireless Cable Tester Company, Cedar Rapids, Iowa, had a representative on hand with some faulty cable and by means of a tone-test and exploring coil located the "bug" promptly.

The Influence of High-Tension Lines on Hailstorms.

In a paper before the French Academy of Science, Mr. von Fagniez recently presented evidence of the effect of a three-phase, 45,000-volt line on a hailstorm.

A hailstorm, introduced by a few ball-lightning strokes, followed the course for 8.5 miles. The high-tension line runs parallel to a chain of mountains some two miles away. Previous to the construction of the transmission line, observations established the fact that the mountain chain attracted hailstorms. This is explained, in that the numerous cross valleys diverted the route of the storms so that they followed the main chain.

Contrary to former observations (the line has been in existence about a year), the hailstorm jumped over all cross valleys and followed the course of the transmission line.

The members of the Academy of Science agreed that the storm was influenced by the high-tension line, but were undecided whether the line was the direct cause of the hailstorm.

Western Electric Annual Report.

The annual report of the Western Electric Company for the fiscal year ended November 30, 1908, will show gross sales for the year, running close to $36,000,000, as compared with gross sales of $52,724,168 for the previous year. In 1907 the Western Electric Company earned $1,217,000 applicable for dividends, paying $1,200,000, or eight per cent, on its capitalization of $15,000,000. The economies effected by the company in operating expenses and the reduction of its floating debt and bills and accounts receivable, from the large amounts of former years, will, it is believed, enable the company to declare seven per cent dividends, if not the rate of the previous year.

October is the best month so far this year, and orders were booked at the rate of $44,000,000 a year. November shows the greatest increase in new business, according to the *Wall Street Journal*. One in close touch with the company's affairs says:

"The electrical business has shown a decided improvement during the last few months. Contracts and new developments, held up on account of financial stress, are now being placed under way again, but we look for the greatest improvement to come after the first of the year. The electrical supply business is the most active branch at the present time. We are also meeting with considerable success in demonstrating a low-pressure turbine which will be placed on the market shortly. During the slack times we conducted a more aggressive educational and sales campaign than ever before. Our advertisements appear in seventeen leading periodicals and numerous electrical and machinery trade papers, and we are getting excellent results both in inquiry and orders booked."

There is now little likelihood that the $15,000,000 five-per-cent bond issue, which was authorized some time ago, will come to light in the immediate future, as the conditions which seemed to make the bond issue necessary no longer exist. The bills and accounts receivable item which, for the year ended November 30, 1906, reached the large total of $24,555,074, was reduced to $18,252,060 in the year ended November 30, 1907, and this year's report will show as great a rate of decrease over the preceding year. The floating debt of $11,500,000 for 1907 is now in the neighborhood of $5,000,000, and as the last report showed quick assets of $21,025,669 and a surplus of $18,252,060, a bond issue is not imperative.

Train Dispatching by Telephone.

The use of the telegraph as an instrument for the dispatching and operation of trains on American railroads will soon become obsolete as the result of a recommendation made by a committee at the recent Chicago meeting of the American Railway Association, which represents over 240,000 miles of railroads.

After an investigation extending over nearly a year by a committee appointed to consider the subject it has been found that the telephone is not only as safe as the telegraph for directing the movement of trains but is more efficient and economical. Therefore the railroads are advised to substitute the newer system for the telegraph gradually.

This has already been done on a large number of roads with marked success on steadily increasing sections of their lines. Railroads running out of Chicago have already installed the telephone on over 3,000 miles of line, and as a result of the decision of the association the installations will be rapidly extended. The two systems have been used side by side in many cases, as the same wires can be used for both, but the investigation of the committee has shown that the telephone is so far superior that there is little object in retaining the telegraph except for commercial purposes. The main advantages, according to the committee, are in the saving in time and in the fact that the telephone can be used by anyone.

The investigation of the possibilities of the telephone and the decision to recommend it as a standard instrument are largely the direct result of the workings of the nine-hour law. This made it necessary for the roads to have three instead of two operators at many stations, and to employ 8,000 additional men, increasing their expenses by over $10,000,000 a year. As the Order of Railway Telegraphers has refused to allow its members to instruct student operators it was in many cases difficult to secure the new men, and the roads immediately turned to the telephone as a possible remedy for the situation.

North Shore Electric Officers.

The annual meeting of the North Shore Electric Company, operating in the suburban belt surrounding Chicago, was held November 30. Directors were re-elected as follows: Samuel Insull, Charles H. Randle, Charles F. Spaulding, Edward P. Russell, William A. Fox, Louis A. Ferguson and Frank J. Baker.

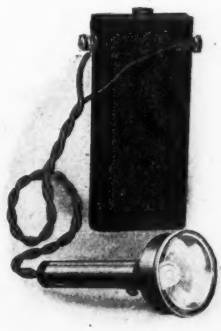
There was represented at this meeting 28,604 out of a total of 29,896 shares.

Electric Head Lamps for Chicago Street Sweepers.

To protect its night workers and sweepers against being run down by the many automobiles which dash rapidly through

STREET CLEANER EQUIPPED WITH ELECTRIC LAMP.

Chicago's boulevards and parkways the South Park Commission has equipped its scavengers with electric head lamps, as shown in the accompanying photograph. The unusual spectacle of these brilliant



PORTABLE ACCUMULATOR AND USUAL FORM OF FLASH LAMP.

little lamps bobbing across the highways in the stretches between the park lights has attracted the curiosity of all who see them for the first time. The lamps are serving their purpose effectively and are a source of very evident pride to their humble wearers.

A two-volt tungsten lamp arranged in a special socket for mounting on the hat of the wearer derives its current from a single pocket storage cell rated at six ampere-hours. This is sufficient to maintain the little lamp from twelve to fifteen hours on a single charge, it is asserted. The storage battery uses lead plates and an electrolyte of so-called "solidified" sulphuric acid, giving a compound of the consistency of table jelly. The cell is about an inch in thickness and measures two and three-quarters by six and one-half inches. It weighs one and one-half pounds.

The charging rate of the cell is one-half ampere, requiring twelve hours for a complete charge. The cell is conveniently charged from a 110-volt direct-current circuit by inserting it in series with an ordinary sixteen-candlepower incandescent lamp.

The outfits, with the exception of the special socket arranged to be fastened on top of the hat, are similar to those used by workmen in oil and gas works, paint factories, etc., and by watchmen, and were furnished by the Vesta Accumulator Company, 1336 Michigan Avenue, Chicago.

Long Trip in an Electric Automobile.

Oliver P. Fritchie, president of the Fritchie Automobile and Battery Company, of Denver, Colo., completed a trip of 1,800 miles, from Lincoln, Neb., to New York city, in an electric victoria of his own manufacture, on Saturday evening, November 28. Mr. Fritchie arrived at the Hotel Knickerbocker, in Times Square, after having been on the road just twenty-eight days.

The motor on the car has a maximum output of ten horsepower, and is geared up to nineteen miles an hour. On one charge it will travel about 100 miles, although on one day it is stated that this distance was exceeded by twenty-five miles, when Mr. Fritchie drove from Toledo to Wooster on one charge. The shortest run was over the blue-clay roads of Iowa, which were sticky and slippery from bad weather, when only forty-five miles was covered.

Although the trip establishes the fact that, under certain conditions, an electric car may be relied upon to travel 100 miles on one charge, it is the opinion of Mr. Fritchie that this record could not be made in an ordinary electric car unless it was handled by an expert electrician.

Proposed Modern Power Plant for India Coal Fields.

Writing from Calcutta, United States Consul-General William H. Michael says that many of the India collieries will have to put in new machinery, some of them complete new equipment, and that to meet this need a company has been organized in Calcutta called the Coalfields Power Syndicate, with a capital of $700,000.

The object is to provide cheap power for coal-mining purposes. The prospectus of the company says that ten per cent of the coal mined in India is consumed at the mines for power, which for 1907 would be a consumption of 915,296 tons, worth $3 per ton.

It is to try and greatly reduce this unnecessary expenditure that the company has come into existence. It is proposed to sell electrical current at one anna (two cents) per unit, and besides power the company will handle up-to-date colliery equipment, kept in stock, in order to meet any emergency. It is believed that the gross revenue will be $113,666 for sale of power and $31,150 from rentals of colliery equipments. In reference to the need of such a syndicate, the prospectus says:

At the present time many collieries have to face an early replacement of much of their plant, and it is partly owing to this that the present demands on the syndicate for power are so large. It is only since the construction of the railways that the coal fields have been seriously worked, and although the progress for many years was slow, the development has been extremely rapid of late, as the following table of coal raised in Bengal will show:

Year.	Persons Employed.	Output in Tons.	Number of Companies.	Capital.
1904	14,896	7,058,980	28	$6,964,366
1905	33,496	7,234,103	33	7,916,152
1906	36,194	8,677,820	37	8,448,517
1907	39,365	9,993,348	77	15,358,000

The above table shows that the number of companies and their capital employed in coal mining increased very slowly until 1907; since then the expansion has been very rapid, but, as will be noticed from the column of output, there has not yet been time for the new companies to develop their mines, and a large part of the increased capital is therefore not yet productive. A natural result of this expansion is the shortage of labor from which the coal fields are now suffering, and which is considerably restricting the operations of fully developed mines. In fact, as shown in the table, the number of miners available has not kept pace with the output, and shows little elasticity in spite of a greatly increased demand. The slow development of the recently-opened mines is also largely due to deficient labor.

Seasoning and Treating Telephone Pole Cross-Arms.

There are used every year in the United States about 14,000,000 cross-arms for telephone and telegraph poles. Of these, perhaps one-fourth are now treated with preservatives to increase their durability, and there are at least five plants, at New York city, Norfolk, Va., New Orleans and Slidell, La., and West Pascagoula, Miss., at which cross-arms are treated. Because of their small size as compared with the strength required and the weakening effect of the holes for insulator pins, and their constant exposure to all kinds of weather, cross-arms should receive a thorough treatment. A good treatment with creosote will at least treble their durability.

A large portion of the supply of cross-arms comes from the South; they are sawed from the loblolly or old field pine, of which there is a large quantity throughout this region. This tree grows rapidly, but contains much sapwood which is difficult to season. It has been said that "loblolly pine sapwood will rot before it will season in the warm, damp climate of the South." While this is probably overdrawn, it is necessary so to pile the cross-arms that the air may circulate freely about them, and to protect them from rain and snow by a roof of loose boards.

Sapwood absorbs preservatives so much more readily than heartwood that when both cross-arms in which sapwood abounds and those in which heartwood predominates are treated in the same run the former absorb an excessive amount before the latter have received what they require. This is not only a needless expense but a detriment, inasmuch as the excess of creosote in the sapwood later oozes out and drips on those who walk beneath. To solve this difficulty, the cross-arms should be sorted in three classes, as sapwood, intermediate and heartwood, and treated in different runs.

Cross-arms are treated in large, horizontal cylinders varying from ninety to 180 feet in length and from six to seven feet in diameter. Into these the arms are run on skeleton trucks, and the doors are then bolted air-tight. Creosote is next run until the remaining space in the cylinder is filled. Pressure is sometimes then applied by pumps to force the preservative into the wood. In some instances before the preservative treatment, the cross-arms are treated to a bath of living steam, followed by the drawing of a vacuum, to remove moisture and secure rapid penetration of the wood by the preservative.—*From Circular 151 on "Creosoting Loblolly Pine Cross-arms," issued by the United States Forest Service, Washington, D. C.*

Electro-Acoustic Method of Measuring Distances at Sea.

Debrix has invented an ingenious method of measuring the distance of a vessel which cannot be seen, because of darkness, fog, or intervening objects. The method is based on the difference between the velocities of sound and Hertzian waves.

At the receiving station, which we may suppose to be a lighthouse or semaphore station on the coast, a train of clockwork causes a pointer to move over a divided dial at the rate of one division per second. The clockwork is started by a Hertzian wave, which is sent out by the ship simultaneously with a sound wave, produced by a gun, siren, or whistle. As the propagation of Hertzian waves is practically instantaneous, the pointer may be regarded as starting at the instant at which the sound wave leaves the ship. The observer on shore watches the pointer and notes its position at the moment the sound reaches his ears. The distance of the ship is then obtained by multiplying the number of divisions traversed by the pointer by the velocity of sound (about 1,100 feet per second).

The position of the ship can be determined with greater precision, says the *Scientific American,* if the Hertzian and auditory signals are received by two shore stations, which can communicate with each other by telegraph or telephone. The distance of the ship from each station having been found, the ship's position on the chart will be at the intersection of two circular arcs drawn about the stations, as centers, with radii equal to the two distances. The result might then be telegraphed to the ship.

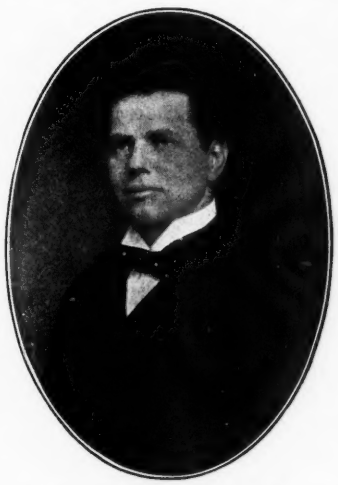
A still better plan would be for each of the chain of coast stations to emit, at regular intervals, simultaneous Hertzian and auditory signals (the stations being distinguished by peculiarities in the signals, as lighthouses are now differentiated). Then any ship provided with the simple receiving apparatus described above could determine its position at any time and make its way safely to port.

Ampere Tablet Unveiled.

A bronze and tile memorial tablet in honor of the French scientist, Andre-Marie Ampere, has been set up in the Lackawanna railroad station at Ampere, N. J., by Dr. Schuyler Skaats Wheeler.

The ceremonies were opened by the acceptance by Vice-President Caldwell, of the Lackawanna Railroad, of the tablet, which His Excellency, the French Ambassador, was requested to unveil.

Dr. Wheeler said that the assemblage had gathered in order to honor the name of Andre Marie Ampere, one of the great founders of electrical science, who was born at Lyons in 1775, and died at Marseilles in 1836. His name has been given to the unit of electrical current, and in every civilized country in the world the word "ampere" is used as much as "pound," "second," or "inch." The present site of the unveiling was named Ampere twelve years ago, but until the Lackawanna Railroad completed the new station there was no appropriate place for such a tablet.



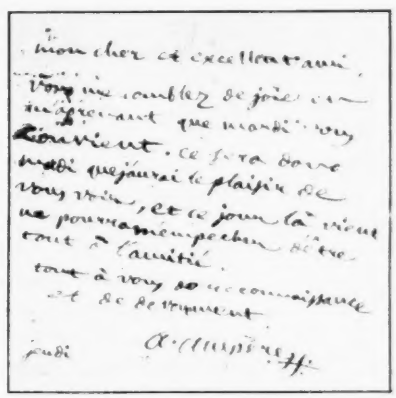
DR. SCHUYLER SKAATS WHEELER, DONOR OF THE AMPERE TABLET.

His Excellency said that nothing was more touching for a man from France, and especially for the representative of France, when traveling in America, than to notice so many places bearing French names, recalling ancient French history. There are so many towns and cities recalling the names of Joliet, Marquette and La Salle, and all those early pioneers who settled in the valley of the Mississippi and the north of this great country, and also the famous series of names, Lafayette, Rochambeau and La Luzerne, which are written on the map and also in the hearts of the people. It must not be believed that America is allowed to honor French names without French reciprocation. In France American names confront one at every step. In Paris will be found a boulevard named after Franklin,

THE AMPERE TABLET, UNVEILED BY HIS EXCELLENCY, THE FRENCH AMBASSADOR, AT AMPERE, N. J., DECEMBER 3.

a street named after Washington, and one named after Lincoln. These names tell of an ancient blessed and solid friendship.

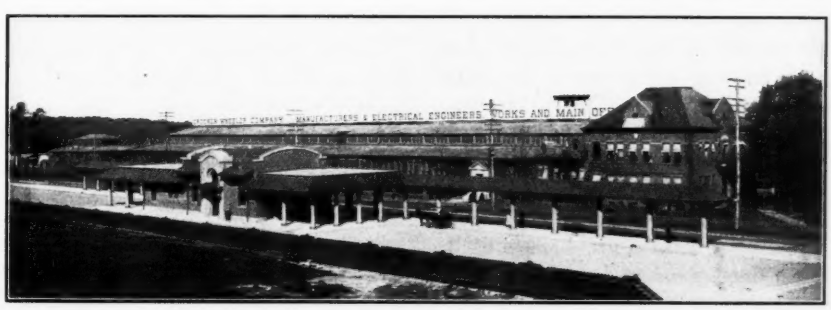
His Excellency is a native of the same town—Lyons—as Ampere. This is one of the oldest cities in France and one of the most peculiar. It is a Roman town, and for a long time was one of the foremost in France, being the first to receive Christianity, and during the Renaissance was at the head of the towns receiving the new learning. Ampere belonged to one of the austere French families. His father was a justice of the peace, and during the revolution followed the dictates of his conscience, and suffered for it. A few hours before his death he wrote in a firm, steady hand his farewell to his wife. He said: "I have in my heart as a consolation the knowledge that I did my duty without fail. I leave you poor, but you will remember that it was through no squandering of mine; no lack of care. The only expense into which I went with some extravagance was for the purchase of mathematical and geometrical books for our little son. There is nothing that I do not expect of him." That little son was the great man who was thus being honored. Ampere's name will survive in books, but, owing to Dr. Wheeler, it will also survive in another way; it will survive on the map of the United States, and the name of Ampere will last forever. His Excellency closed by saying: "As a Frenchman and compatriot I wish prosperity and happiness to Ampere."



AN AMPERE AUTOGRAPH LETTER.

Production of Platinum in the United States.

The decline in price of ingot platinum on the New York market from $38 per troy ounce on January 1, 1907, to $25 per ounce on December 31 of the same year, was accompanied by a notable decrease in production of fine platinum—from 1,439 ounces, valued at $45,189 in 1906, to 357 ounces, valued at $10,589, in 1907. Of the total output in the later year 300 ounces came from Butte, Del Norte, Humboldt, Placer, Plumas, Trinity and Sacramento counties, in California, and fifty-seven ounces from Coos, Curry and Josephine counties, in Oregon.



BIRD'S-EYE VIEW OF THE CROCKER-WHEELER COMPANY'S WORKS AT AMPERE, N. J.

THE NEW YORK MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

ANNUAL MEETING, DECEMBER 1-5. PAPERS AND DISCUSSION.

The subjects attracting the greatest attention at the annual meeting of the American Society of Mechanical Engineers, held December 1-4, in the Engineering Societies Building, New York, were the conservation of national resources, machine-shop practice, aeronautics and the training of workmen. But one paper was presented on this latter subject. The ensuing discussion, however, was most enthusiastic and of a most illuminating character.

The convention was opened on Tuesday evening, with President M. L. Holman's address on the conservation of our national resources. Mr. Holman was present at the recent conference called by President Roosevelt, as the representative of one of the four great engineering societies. In his address he reviewed briefly the work of this conference and the scope of the movement. He touched on the importance of the health and life of the people as a national resource, and the work that is being done along this line. The conserving of the timber supply is another subject of considerable importance. The work of the irrigation engineer enters here as making arid lands available for timbering, and the timbering of land conversely reacts favorably on the fertility of the country. Closely allied to irrigation problems are those of waterpower, although this latter cannot be properly called a problem of conservation. It is merely one of development; the water is there, and its use or non-use for power development does not decrease or increase the available supply. The only real interest in this subject from the conservation standpoint is the preserving to the public good the water rights of available power possibilities. The address went deeply into the subject of mineral resources, chief among which are fuel and iron ore. Improved methods of mining are necessary, both to avoid waste of the material mined and to decrease the awful loss of human life, which is far worse in America than in foreign countries. An interesting point brought out in connection with the conservation of iron ore was that eventually only enough ore would have to be mined to replace the losses of wear and tear. There are thousands of tons of iron in scrap piles which are not utilized because it does not pay to rework it. As the available supply of ore diminishes the scrap dealer will be a much more important factor than he now is.

Following the presidential address, Dr. John A. Brashear was presented to the society for honorary membership, which was conferred on him by President Holman. Dr. Brashear then delivered a most brilliant lecture on stellar photography, in which he traced the formation of planets, etc., illustrating his talk with some remarkable photographs of nebulæ and other celestial objects. He also outlined the method of calculating siderial distances and other computations in the field of astronomy.

The Wednesday morning session was partially given up to a paper on the relation of the engineer to the people, by Morris L. Cooke, who thought that many present-day conditions, among them the broadening of human knowledge, and the generally recognized necessity for co-operation, will force the engineering profession and the individual engineer to take a more direct interest in affairs affecting the public. If engineering is to take full possession of the field which the public is willing it should occupy, more effort must be made to enlighten the public as to the objects and achievements of engineering, more effort must be put forth along lines of purely public interest, and every opportunity given the public to co-operate with the engineer. The discussion on this paper emphasized the necessity of acquainting the public more fully with its vital relationship to the engineering profession, and the necessity of having legislation which involves questions of engineering guided by the national engineering societies. It was shown how proper co-operation between the public and other professions, such as medicine and architecture, had served to bring about an increasing appreciation of their value to the public.

The principal feature of this session was a comprehensive paper by Major George O. Squier, of the Signal Corps of the United States Army, which dealt with the present status of miltary aeronautics. This paper outlined quite completely the types of successful military balloons in the United States and foreign countries, detailing the construction of the dirigible French types, of Count Zeppelin, and of the United States and England. It also took up the problems of design of these types, and then discussed aeroplanes in much the same fashion. The work of Herring, Farman, the Wright brothers and others was explained, and the action of airshps was compared to that of vessels navigating the water. The application of airships to warfare was considered, and it was shown, and the manner in which they would work for peace and delimit frontiers was brought out.

In connection with this subject, Lieut. Frank P. Lahm, also of the Signal Corps, gave a stereopticon lecture on Wednesday evening, which was also illustrated with moving pictures, showing in flight the Zepplin dirigible balloon, and the Wright brothers' aeroplane.

The Wednesday afternoon session comprised two papers on fuel-oil burning, by C. R. Weymouth, of San Francisco, Cal., and two others on the total heat of saturated steam and on a method of obtaining ratios of specific heat of vapors. In Mr. Weymouth's first paper are presented results of tests at the 15,000-kilowatt power plant of the Pacific Light and Power Company, Redondo, Cal., having steam-engine prime movers, crude oil being used as fuel. The fuel economy is stated for tests on a 5,000-kilowatt plant unit at various uniform loads, approximating 2,000, 3,000, 4,000 and 5,000 kilowatts; on a variable railway load; and also for the entire station on a similar variable railway load. The operating and test conditions are fully described.

The results given indicate a remarkable plant economy under all conditions, but the particularly striking feature is the almost uniform fuel economy for the plant unit for all fractional loads from about one-half load up to the maximum load tested. The author believes that the results warrant a careful investigation as to the possibilities in the line of superior plant fuel economy, using the more modern types of steam engines as prime movers.

The second paper described the unnecessary losses in firing fuel oil and an automatic system for eliminating them as installed in the Redondo plant.

An oil-pump governor actuated by variations in the boiler steam pressure so varies the oil pressure in a common oil main, and accordingly the simultaneous rate of firing in all burners, as to maintain practically uniform steam pressure at the boilers. This variation of pressure in the oil main is the secondary means for controlling the supply of steam to the burners for purposes of atomization, and also for controlling the amount of damper opening, and thus the air supply for combustion. Due to this automatic and

synchronous adjustment of all the functions of the boiler and furnace, there results on plants subject to fluctuating load an increased boiler economy, which is due to the more uniform rate of firing, the saving in steam used for atomizing the oil and the reduction to a minimum of the air supply for combustion.

In the discussion which followed these papers, the speakers almost uniformly took exception to the implied statement that reciprocating engines were largely responsible for the good showing made, and to the statement that as a steam turbine would only show high economy in connection with a good vacuum, the vacuum should be charged back against the turbine. This was considered to be most unfair to the turbine. The speakers all contended that turbines, operating under similar conditions, would show just as high if not higher economy than the engines.

A. R. Dodge's paper on the specific heat of vapors considered a method of obtaining ratios of specific heats which does not involve the use of available steam tables conceded to be too inaccurate for such investigations, nor a condition in which the steam is presumed to be without moisture or superheat. This method is based upon the expansion of initially superheated fluid in a throttling calorimeter, and tables are included showing data for steam.

Harvey N. Davis' paper on the heat of saturated steam stated that Regnault's formula for the total heat of saturated steam, $H = 1091.7 + 0.305\ (t - 32)$ British thermal units, is considerably in error. This conclusion is confirmed by computing H above 212 degrees, in terms of H_{212}, from the throttling experiments of Grindley, Griessmann and Peake, and the direct specific-heat determinations of Knoblauch and Jakob. The result is: $H = H_{212} + 0.3745\ (t - 212) - 0.000550\ (t - 212)^2$. The best value of H_{212} seems to be 1150.3 British thermal units. The range of the new formula is from 212 degrees to about 400 degrees. The greatest error in Regnault's formula in this range is six British thermal units at 275 degrees, but if extrapolated to higher temperatures the error in it increases very rapidly. Below 212 degrees the observations of Dieterici, Smith, Griffiths, Henning and Joly show a thoroughly satisfactory agreement among themselves, and prove that Regnault's formula runs high, the error reaching eighteen British thermal units at thirty-two degrees. There are corresponding errors on the specific volume values ordinarily used.

Most of the speakers discussing these two papers did so by means of complicated formulæ on the blackboard, which it was impossible for the audience to follow.

The papers presented on Thursday morning were almost wholly devoted to machine-shop practice. A. L. De Leeuw read one on efficiency tests of milling machines, which points out the desirability of indicating the power of a machine tool by the amount of metal which it is capable of removing. It shows the results of tests made for finding the net horsepower required to remove a given amount of metal under given conditions. Other tests were made to determine the efficiency of the feed and driving mechanism. In this connection an electrical method was used, comprising two machines, rigidly connected at their spindles, one being driven by a motor, and the other driving a generator. The power input was determined, from the electrical readings, the efficiency curve of the motor being known, and the output of the generator was also measured. From the difference in power of the two electrical machines the efficiency of the milling machines was easily determined. The discussion on this paper, and on the one which followed, describing a new high-speed milling cutter, dealt mostly with questions of the proper shape of metal cutting tools, and incidentally touched on the revolution in machine-shop practice brought about by the motor drive.

A paper on interchangeable involute gear-tooth systems, by Ralph E. Flanders, gave diagrams showing the effect of varying the pressure angle and addendum on the various practical qualities of gearing, such as interference, number of teeth in continuous action, side pressure on bearings, strength, efficiency, durability, smoothness of action, permanency of form, etc. After comparing typical examples of interchangeable gear systems in these particulars, the author concludes that a new standard for heavy, slow-speed gearing is advisable.

The paper provoked a rather aimless discussion which showed mainly that there were yet many things to be learned about gearing. The discussion was so protracted that it had to be continued at an afternoon session, at which Norman Litchfield's paper on spur gearing in heavy railway-motor equipments was read and which dealt with the breakage of gearing in heavy electric-railway service, as typified by the equipments of the Interborough Rapid Transit Company, New York, which operates the elevated and subway lines. A resumé is given of the methods employed to overcome the breakage, and the strains in the teeth as calculated by the Lewis formula are shown. Attention is called to the fact that this formula is not entirely applicable on account of the difficulty in maintaining alignment of gear and pinion.

The paper attracting the most attention at the regular Thursday afternoon session was Henry L. Gantt's on training workmen in habits of industry. In this paper Mr. Gantt says that until within a few years the mechanic was necessarily the source and conserver of industrial knowledge, and on him rested, therefore, the responsibility for training workmen. With the advent of the scientifically-educated engineer capable of substituting a scientific solution of problems for the empirical solution of the mechanic, the responsibility of training workers naturally shifts to his shoulders. If he accepts this responsibility, and bases the training on the results of scientific investigation, the efficiency of the workman can be so greatly increased that the manufacturer can afford to give those that take advantage of this training compensation in excess of that usually paid for similar work.

Many speakers warmly praised Mr. Gantt, who was associated for many years with F. W. Taylor while the latter was developing his system of shop management. It was brought out that men trained under Mr. Gantt's principles made better workmen, better managers, received higher pay and were more contented than the average man. The speakers especially commended the helpful and humanitarian tone of Mr. Gantt's paper, in which it was shown that the operation of the principles therein enunciated was to the benefit of employer and workman alike. The testimony of all who had used the systems developed by Mr. Gantt and Mr. Taylor was to the effect that the results were far beyond their most sanguine hopes.

A liquid tachometer was described at this session by Amasa Trowbridge, of great accuracy and simple construction.

A paper of considerable interest was that of C. J. Mellin on articulated compound locomotives, which was discussed by S. M. Vauclain by means of lantern slides which traced the development of the Mallet locomotive.

Another paper of considerable interest, also accompanied by lantern slides, was

that of S. Ashton Hand, on industrial photography. Mr. Hand outlined the steps necessary to attain success in photographing machinery, and gave a resumé of the methods used by him to correct errors of focusing, exposure, developing and printing. The paper was most interesting and was well received.

At the meeting of the Gas Power Section, held Thursday afternoon, L. H. Nash gave some reminiscences of gas-engine design, which formed a brief outline of certain features that have been tested from time to time, many of which have taken their places in the development of the gas-engine art, some being abandoned after trial for commercial use. The intention of the article is to stimulate thought along the lines referred to. Among other things, is a brief mention of a method of operation for marine purposes, many of the chief features of which are in more or less active service today, although there are others which seem to possess value enough to warrant their being brought to the attention of the engineering profession.

Another paper presented at this session was entitled "Possibilities of the Gasoline Turbine." This was by Prof. Frank C. Wagner. In order to reduce the temperature of the gases at the turbine wheel, either an excess of air or water injection may be used. The relative efficiencies of the two methods was shown to depend upon the amount of compression used, and the efficiencies of the turbine and the air compressor. The work required to compress the air may be materially reduced by using two-stage or three-stage compressors with intercoolers. It appears that with high compression the gasoline turbine may be expected to give efficiencies comparing favorably with the reciprocating gasoline engine.

The papers read at the Friday morning session attracted but little attention, due mainly to the many excursions arranged for this time, which cut into the attendance on the professional session. The papers were on the slipping points of rolled boiler-tube joints, on the storage and transmission of carbonic acid and on an averaging instrument for polar diagrams. There was almost no discussion, and the meeting adjourned at an early hour. During the meeting it was announced that Jesse M. Smith, of New York, had been elected president, and that 191 new members had been elected. Preliminary steps for the formation of a section on the machine shop were also taken.

The entertainments and excursions provided for the meeting were on an elaborate scale. In addition to the two illustrated lectures noted above, and the regular reception, there were excursions to various power stations around New York, to the Pennsylvania tunnels and terminals, to the Queensboro bridge, to the high-pressure fire-service stations, and to many manufacturing plants.

Hudson River and Pennsylvania Telephone Companies Absorbed by the Bell.

Stockholders of the Hudson River Telephone Company and the New York & Pennsylvania Telephone and Telegraph Company have been advised by Francis G. Wood, secretary of the companies, that their stock holdings will be exchanged for stock in the Bell Telephone Company of Pennsylvania. The exchange will be made on the basis of one share of Bell Telephone Company of Pennsylvania stock for two shares of New York & Pennsylvania Telephone Company stock. In the case of the other company, the offer is on the basis of one share of Bell Telephone Company of Pennsylvania for one-and-one-half shares of Hudson River Telephone Company.

The outstanding capital stock of the Hudson River Telephone Company is $3,909,900; of which $2,033,100 is owned by the American Telephone and Telegraph Company. The latter company also owns half of the $1,000,000 capital stock of the New York & Pennsylvania Telephone and Telegraph Company.

The Bell Telephone Company of Pennsylvania operates throughout a large part of Pennsylvania, New Jersey, and Maryland, and in a portion of Delaware and the District of Columbia. It embraces such cities as Philadelphia, Harrisburg, Allentown, Wilkesbarre, Lebanon, Williamsport, Camden, Wilmington, and other points, and further south it includes Baltimore and Washington.

The gross earnings of the Bell Telephone Company of Pennsylvania, in 1907, were $7,670,439; net earnings were $2,410,953. This was an increase of $925,931 in gross over 1906, and $456,835 in net earnings.

The Bell Telephone Company of Pennsylvania has paid a dividend of six per cent for a number of years. The Hudson River Telephone Company has paid no dividends since the latter part of 1907, when it paid four per cent. The New York & Pennsylvania Company has paid no dividends since 1900.

Steam Railroads Must Exchange Carload Freight with Indiana Electric Lines.

The Indiana Railroad Commission has rendered a decision making it incumbent upon a steam road to enter into an interchange of carload traffic with an interurban road, regardless of whether two or more steam roads have entered into an agreement not to exchange their car traffic. The decision followed litigation between the Winona Interurban Railway Company and the Big Four Railroad, wherein the former sought to compel the latter to deliver any cars to the interurban railway at Warsaw. The Commission holds that interchange of traffic such as is involved in this case, and where there is a physical connection between the steam and interurban line, would enlarge the opportunities of the shipping public, and would also bring steam and interurban roads into rightful competition.

The contention of the officials of the steam line that the interchange of traffic in carload lots with interurban roads would bring their equipment under the control of the interurbans and their rolling stock into use for interurban business, the Commission holds is not well taken since the Commission can and will prevent any such abuse of equipment by the interurban companies. The decision is regarded of great importance, and it remains to be seen if the steam road will make any further resistance to the order of the Commission. S.

Pennsylvania Trolley and Light Merger.

The United Gas and Electric Light Company and the Irondale Electric Light Company, of Bloomsburg; the Standard Gas Company, of Danville; the Berwick Electric Light Company, of Berwick, and the Columbia & Montour and the Danville & Bloomsburg Electric Railway companies, all in Pennsylvania, have been merged into one corporation.

The electric power houses in some of the towns mentioned will eventually be dispensed with, it being the purpose to secure some of the power necessary for operating the trolley roads from Harwood, near Hazleton, where a mammoth plant, which uses the culm from nearby banks for fuel, has been erected.

The personnel of the new company is not announced. The deal was consummated by E. R. Sponsler, of Harrisburg, and A. W. Duy, of Bloomsburg, who have been working on it for several months.

It is understood that a number of improvements will be made.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

ONEIDA RAILWAY COMPANY.

The report of the Oneida Railway Company for year ending June 30 shows as follows: Gross operating revenue, $288,972; operating expenses, $184,448; net operating revenue, $104,524; taxes accrued, $5,830; operating income, $98,694; other income, $1,279; gross corporate income, $99,974; fixed charges, $3,910; net corporate income, $96,064; cash on hand, $23,657; profit and loss, surplus, $91,095.

MASSACHUSETTS ELECTRIC.

The Massachusetts Electric Companies has issued its ninth annual report, covering the year ended September 30, 1908. The consolidated income account shows as follows: Gross, $7,809,010; expenses, $5,001,517; net, $2,807,492; charges, $1,784,437; balance, $1,023,054; dividends, $880,773; surplus, $142,281, as against $174,462 for the previous year. The profit and loss statement of the parent company compares as follows: Dividends on stock owned, $880,841; miscellaneous interest on notes, $107,961; total income, $988,802; total expenses, $19,395; net income, $969,407; interest on notes, $157,500; surplus, $811,907; total surplus, $2,378,791, which compares with $1,566,884 for the preceding year.

The number of passengers carried by the Boston & Northern and Old Colony street railways, constituent companies of the Massachusetts Electric Companies, during the fiscal year ended September 30, 1908, was 149,649,383, against 148,554,127 in the 1907 fiscal year, an increase of 1,095,256, or three-fourths of one per cent. The 1907 increase over 1906 was 5,990,991, or 4.2 per cent.

The annual meeting of the Massachusetts Electric Companies will be held at Tremont Temple, Boston, December 16, at noon. Shareholders will be asked to authorize the trustees to sell the six per cent preferred stock of the subsidiary companies, which the railroad commissioners recently authorized.

NORFOLK & PORTSMOUTH TRACTION.

The report of the Norfolk & Portsmouth Traction Company for the month of October and ten months ended October 31 shows as follows: October—gross, $156,795; expenses, $88,316; October—net, $68,479, as against $98,561 for October, 1907. Ten months' gross, $1,552,029; expenses, $923,587; ten months' net, $628,442, as compared with $875,190 for 1907.

SYRACUSE RAPID TRANSIT.

The Syracuse Rapid Transit Railway report, as filed at Albany, for the year ended June 30, 1908, is as follows: Gross, $1,292,886; expenses, $822,197; net, $470,689; other income, $19,405; total income, $490,094; charges, $334,606; surplus, $155,488; dividends, $70,188; year's surplus, $85,300, which compares with $127,808 for the preceding year. Cash on hand, June 30, $85,300; profit and loss surplus, $439,931.

UNITED TRACTION OF ALBANY.

The United Traction Company's report, as filed at Albany, for the quarter ended September 30, 1908, is as follows: Gross, $520,679; expenses, $302,187; net, $218,492; other income, $40,014; total income, $258,506; charges, $98,877; surplus, $159,629, as against $174,854 for the preceding year.

HUDSON VALLEY RAILWAY COMPANY.

The Hudson Valley Railway Company's report, as filed at Albany, for the quarter ended September 30, 1908, shows as follows: Gross, $196,474; expenses, $135,558; net, $60,916; charges, $56,661; surplus, $4,255, a decrease of $34,418, as compared with the corresponding quarter of 1907.

NORTH SHORE ELECTRIC.

For the fiscal year ended September 30, 1908, the North Shore Electric Company, which supplies electrical energy in the suburbs about Chicago, reports gross earnings of $815,551; expenses (including taxes and rentals), $533,619; net earnings, $281,932; interest on bonds, $159,283; special depreciation reserve, $64,100; dividends, $42,702; balance, $15,847; total surplus, $119,970. The plants, real estate, franchises, etc., were valued at $7,110,924 and the total assets at $8,096,745. The outstanding capital stock was $3,780,000; bonds amounted to $3,715,000. The profits for the year were equal to substantially three-and-one-half per cent on the capital stock.

LONDON UNDERGROUND.

The Underground Electric Railways of London report earnings for each division of the system for the week and twenty weeks ended November 14 as follows: Baker Street and Waterloo, £3,145; Piccadilly, £5,445; Hampstead, £3,530; District, £10,106; Tramways, £5,192; total, £27,418, an increase of £2,354 over the same week of 1907. Total twenty weeks to date, £560,511, compared with £484,362 for the preceding year, an increase of £76,449.

DETROIT UNITED.

The report of the Detroit United Railway Company (all properties) for the month of October and ten months ended October 31 is as follows: October gross, $613,127; expenses and taxes, $412,650; October net, $200,477; other income, $6,363; total income, $206,840; charges, $133,379; October surplus, $73,461, which compares with $66,122 for October, 1907. Ten months' gross, $5,937,982; expenses and taxes, $3,807,903; ten months' net, $2,130,079; other income, $51,420; total income, $2,181,499; charges, $1,352,239; ten months' surplus, $829,259, as against $954,363 for the corresponding months of 1907.

ROCHESTER & EASTERN RAPID.

Rochester & Eastern Rapid Railway's report, as filed at Albany, for the year ended June 30, 1908, is as follows: Gross, $279,816; expenses, $221,520; net, $58,296; other income, $207; total income, $58,503; charges, $106,214; deficit, $47,711, which compares with a deficit of $30,095 for 1907.

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of October is as follows: October gross, $328,608; expenses, $168,124; October net, $160,484; charges, rentals, etc., $27,480; October surplus, $133,003, as compared with $119,455 for the corresponding month of 1907.

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of October and ten months ended October 31 is as follows: October—Gross earnings, $218,074; operating expenses, $119,982; net earnings, $98,092; other income, $187; total income, $98,279; charges and taxes, $71,953; surplus, $26,326, as against $30,138 for October, 1907. January 1 to October 31—Gross earnings, $2,082,897; operating expenses, $1,139,806; net earnings, $943,091; other income, $3,260; total income, $946,351; charges and taxes, $707,696; surplus, $238,655, a decrease of $11,786 from the surplus for the corresponding period of 1907.

ALTERNATING CURRENTS AND THEIR APPLICATIONS.

BY EDSON R. WOLCOTT.

CHAPTER II. (PART I).—GENERATORS.

TYPES OF ALTERNATING-CURRENT GENERATORS.

In order to generate an electric current there must be relative motion between a conductor and a magnetic field. So far as the production of the current is concerned, it is immaterial whether it is the conductor or the magnetic field that is in motion.

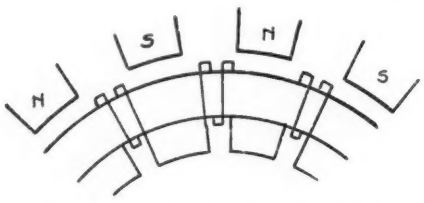


FIG. 38.—RING-WOUND ARMATURE.

In an alternating-current generator in which the conductor rotates and the magnetic field is stationary we have what is known as the rotating-armature type of alternator. It is similar to the direct-current generator in arrangement of analogous parts.

When the magnetic poles are rotated past a stationary armature in which the electromotive force is induced, the machine is called a rotating-field alternator.

In the inductor type of alternator both armature and field parts remain stationary, while the rotation of a magnetically-conducting element past the parts effects an alternating shunting of the field flux through the armature coils, securing the relative motion defined as necessary to electromagnetic induction.

THE ELECTROMOTIVE FORCE OF AN ALTERNATOR.

The electromotive force generated by an alternator as read by a voltmeter at the terminals is as follows:

$$\text{Terminal voltage} = \frac{2\pi f \phi N}{\sqrt{2}\,10^8} = \frac{4.44 f \phi N}{10^8}$$

where N represents the number of turns of wire in series enclosing the magnetic flux, ϕ the number of lines of force from each pole passing through the winding in which the electromotive force is generated, and f the cycles per second, which equals the number of revolutions per second multiplied by one-half the number of poles. The voltage is thus proportional to the strength of the magnetic field, the number of conductors in the armature, the number of poles and the speed.

ROTATING-ARMATURE GENERATOR.

The rotating-armature generator is a type that has played a very important part in the development of alternating currents, although it is now being displaced by machines in which the field coils rotate.

The armatures of this class of machines have been wound in various ways. At first the armatures were in the shape of discs. Later they took the form of iron rings wound with insulated conductors, as shown in Fig. 38. The type generally in use in this country, however, is the so-called drum armature, illustrated in Fig. 39. It is similar in appearance to that used in a direct-current generator, although the simple alternator has no commutator, being provided with only collecting rings. In some machines, however, there is a commutator for rectifying part of the current for exciting the fields. The armature windings are embedded in slots in the laminated iron core. The more iron around the conductors and the less air-gap between them and the magnetic poles, the greater will be the magnetic flux. The iron is laminated transversely to the axis to decrease the eddy-current losses.

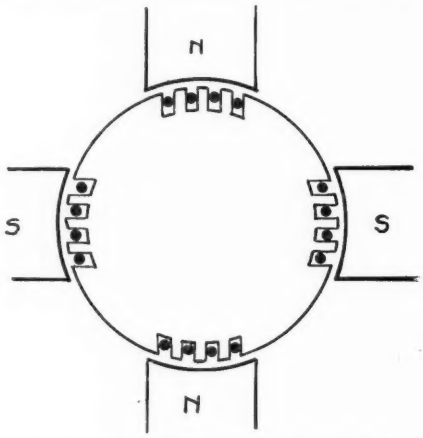


FIG 39.—DRUM-WOUND ARMATURE.

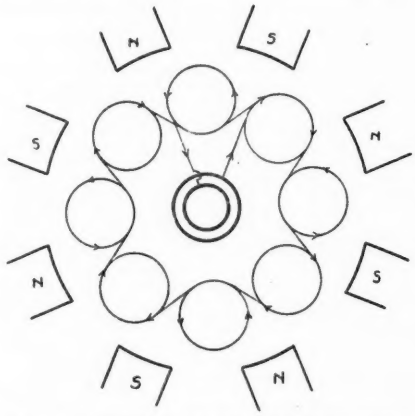


FIG. 41.—METHOD OF CONNECTING ARMATURE COILS OF AN EIGHT-POLE ALTERNATOR.

A six-pole generator of this type is illustrated in Fig. 40. The six pole windings are arranged symmetrically within the iron frame. The armature windings are in six corresponding coils, all connected in series; the terminals are connected to the collecting rings in the center, as shown. The magnetic lines of force pass from an N pole across the short air-gap into the iron core within the surrounding coil of insulated conductor, and then divide, part of the flux passing in one direction through the iron and up through the coil opposite one of the adjacent S poles, and part to the S pole on the other side.

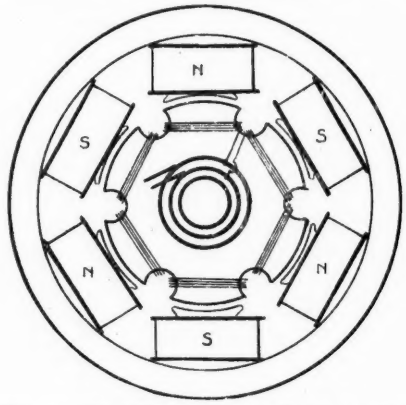


FIG. 40.—SIX-POLE, SINGLE-PHASE ALTERNATOR.

METHOD OF CONNECTING COILS.

The method of connecting the coils is shown more clearly in Fig. 41. Consider the loops as filled with iron, the coil being wound within the slots opposite the pole pieces. Adjacent coils are wound in opposite directions, as the adjacent poles are of opposite polarity. They are all connected in series, as shown, and the terminals are connected to the collecting rings in the center. The current is taken from these by means of brushes (not shown).

EXCITING CURRENT.

A direct current in the field coils is necessary to produce the magnetic flux. This is usually obtained by means of a small direct-current generator. The alternator is then said to be separately excited.

MAGNETIC SATURATION.

When an alternator is driven at constant speed and no load, no current being drawn from its armature, its electromotive force increases, approximately as the current through the field coils increases,

up to a certain point, as shown in Fig. 42. At the maximum the iron is said to be saturated with magnetism, since any further increase of the field current is

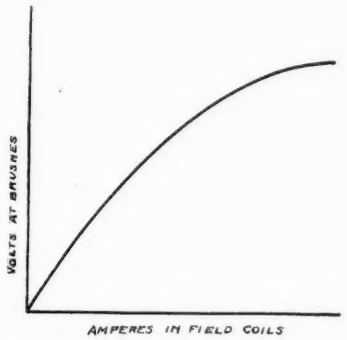


FIG. 42.—MAGNETIC SATURATION OF ALTERNATOR FIELD.

without effect on the electromotive force generated.

When iron is magnetized it may be considered that some of its component particles swing into line just like so many compass needles near a magnet.

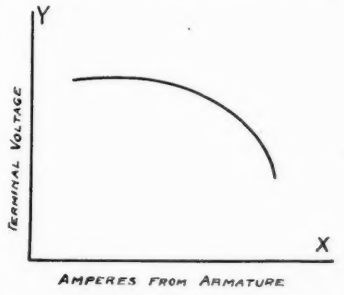


FIG. 43.—DROP OF ALTERNATOR ELECTROMOTIVE FORCE WITH INCREASE OF LOAD.

The more the iron is magnetized the greater the number of particles are to be thought of as lined up in the same direction, until finally, when they are all in line, the magnetic "saturation point" is reached.

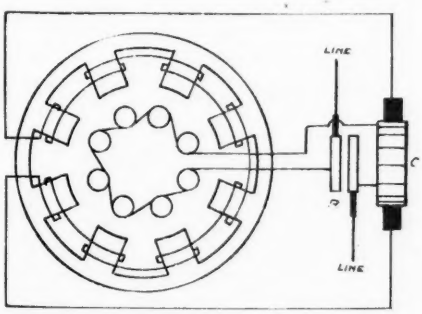


FIG. 44.—SERIES-WOUND ALTERNATOR.

RELATION BETWEEN TERMINAL VOLTAGE AND LOAD.

As the load on an alternator changes, the field excitation remaining constant, the electromotive force drops, as shown in Fig. 43. The voltage at the terminal of the generator is plotted along the axis OY, and the current drawn from the armature is plotted along the axis OX. As the load increases, the voltage decreases. Increasing the current through the field coils will again increase the electromotive force generated. This can be done by hand regulation of a rheostat placed either in the external circuit of the direct-current exciter or in the field circuit of the exciter in case the latter is a shunt-wound machine.

SERIES-WOUND ALTERNATOR.

When all of the current is rectified and passed through the field coils, the generator is series wound and is much like the series-wound direct-current machine. The method of connection is illustrated in Fig. 44. The armature windings are represented by the inner coils; one of the terminals is connected to one of the collecting rings R and the other to the commutator C, which is again connected to the other collecting ring. The current is thus unidirectional only while passing through the field coils.

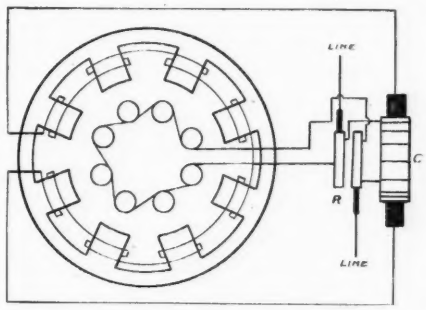


FIG. 45.—SHUNT-WOUND ALTERNATOR.

SHUNT-WOUND ALTERNATOR.

In the shunt-wound type the commutator difficulties are not so great, for only a part of the current passes through the field coils, as shown in Fig. 45. The armature is connected directly to the collecting rings, and the field coils are connected in parallel through the commutator.

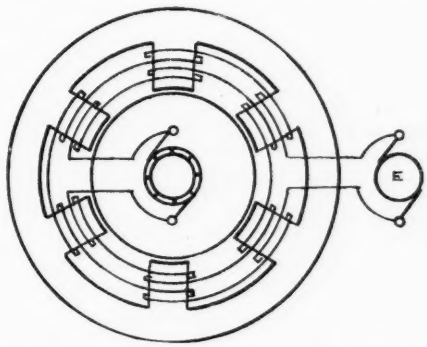


FIG. 46.—COMPOSITE EXCITATION OF ALTERNATOR.

SEPARATELY-EXCITED ALTERNATOR.

A very common method of excitation is by means of a direct current from a storage battery or a small direct-current generator belted or direct-connected to the alternator, or to the prime mover. The current through the fields is usually controlled by hand regulation by means of a rheostat in the alternator field circuit or in the shunt winding of the exciter. This is known as a separate excitation.

COMPOSITE EXCITATION.

In some cases there are two separate windings in the field coils, one for self-excitation, the other for separate excitation, as shown in Fig. 46. The regulation of the alternator is then partly automatic, but subject at the same time to hand regulation, thus making a very practical combination.

[To be continued.]

Electrician's Helper—United States Civil Service.

The United States Civil Service Commission announces an examination on January 13, at the usual places, to secure eligibles to fill a vacancy in the position of electrician's helper, $50 a month, in the office of the Secretary, Department of Agriculture, and other vacancies requiring similar qualifications.

With reference to the above specific vacancy the Department states that the length of time that it will be able to retain the services of an electrician's helper depends on the amount of work that comes into the shop and also the funds available for the employment of a helper, both of which are impossible to determine in advance.

The examination will consist of subjects weighted as indicated:

Letter-writing, over 125 words, 10; practical questions, elementary in character, relating to the wiring of buildings and installation and care of minor electrical apparatus, 45; experience as electrician's helper, 45.

Applicants whose applications show that they have had less than one year's experience as electrician's helper will not be admitted to the examination. Age limit, eighteen years or over on the date of the examination.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any of the usual places, for application Form 1093.

Developments in Electrification of Railway Terminals.

At a regular meeting of the Western Society of Engineers, held on the evening of December 2, H. H. Evans, secretary of the Chicago council committee on local transportation, presented an interesting paper on "Developments in Electrification of Railway Terminals." It was based principally upon the investigation of the subject made by Mr. Evans and other city officials of Chicago relative to the electrification of the Chicago terminals, particularly that of the Illinois Central Railroad, and which resulted in a voluminous report that was recently completed and which was abstracted in the WESTERN ELECTRICIAN of October 31.

Mr. Evans said that electrification of terminals may be brought about for three distinct reasons: 1, to obviate the nuisance to the public in general and to the passengers in particular; 2, to effect a saving in operation, or 3, to increase the capacity of the system. Each of these factors may be involved to a degree, although usually one of them predominates.

The density of traffic is a vital factor in determining the feasibility of any electrification project. A number of these projects have been carried out in cities that have tunnel entrances to the terminals. In such a situation electrification is practically imperative on account of the danger to life from smoke and sulphurous fumes in the tunnels. The damages caused by smoke, cinders and other objectionable features of steam locomotives both to property adjacent to the lines and to the discomfort of passengers are becoming elements that are bringing about electrification in an increasing number of instances.

The advantages of electrification to any railroad, particularly at its terminals, are manifold. Less cleaning and therefore less wear will be required of the passenger coaches. Decidedly longer life will be allowed to viaducts, bridges and other steelwork over or adjacent the tracks. This will be due to the elimination of sulphurous corrosion, which has weakened and greatly shortened the life of such structures; a viaduct in Boston that was recently examined was a forcible illustration of this fact. Less wear and tear will result on the rolling stock because of the uniform tractive power of the electric motor.

A higher working speed and therefore considerably more mileage is possible with electrical equipment because of the much higher acceleration produced. There will be much less dead movement and dead switching, as the electric locomotive does not have to go to the roundhouse after each run. The New York Central has cut down its dead mileage at the New York terminal more than one-half. There will result a much greater economy in coal consumption, about one-half of that of steam being found sufficient. This factor is of much greater importance where the cost of coal is fairly high. This saving in coal has led to the electrification of at least one or possibly two roads near San Francisco.

The electric locomotive is always ready for operation. Its cost of repairs is decidedly less. This has been found to run about three cents per mile against eight to eleven cents with the steam locomotive. This item is still less on electrically-equipped coaches, particularly where the multiple-unit system is used. With the latter system the entire cost of repairs of steam locomotives in suburban service can be saved. No dead weight has to be hauled as in the case of the locomotive tender loaded with coal and water. Greater loads are possible on an electrified system, since these are limited only by the strength of the drawbar. Delays due to bad weather are very much diminished when the electric locomotive is employed. Its efficiency, if anything, is increased in cold weather, whereas that of the steam engine is much reduced.

The higher speed attainable with electrified service results in a much higher car-mileage capacity. The reasons for electrifying suburban service have generally been rather for getting more revenue from it than for saving money in its operation. The higher speed attracts a greatly increased traffic. With stations as near together as they usually are in suburban service the increased acceleration permits of this higher speed. Operation on the multiple-unit system allows much more frequent service, which is another factor in building up the traffic.

One hour is the maximum limit that people going to and from work care to spend in traveling, even to the remotest suburbs. Increased and faster service on the street cars has increased the distance to which people are being daily carried and has resulted in building up the suburban districts. As the city builds up, however, the zone of the congested traffic steadily widens and this element limits the speed of street-car service. To reach the desirable suburbs, therefore, the most satisfactory means of transportation are by elevated or subway lines, both of which are very costly to build, or by means of the steam railroads that pass through the suburbs. Electrification of their lines seems the very best and cheapest way of building up the suburban districts.

While most electrification projects have at first been confined to suburban traffic only, the complete equipment of the road, so as to provide for the through passenger and freight service as well, results in a very much better load factor on the generating station, since freight is generally moved at other than the rush hours.

Real estate required for the large terminals in our great cities is steadily becoming more expensive. In order to provide for the gradually increased traffic enlarged capacity is necessary, and the cheapest way to obtain it is by electrification, as the present facilities can then be made to accommodate an increased number of trains. To even out the load factor a light freight and express traffic may readily be developed to accommodate the large merchants of the city. This may be arranged to deliver parcels to suburban districts frequently and quickly.

Where the cost of real estate is as high as for instance in New York city, the plan of building an office or warehouse structure over the tracks may be resorted to where these are electrically equipped. It has been proposed to build eighteen or twenty-story warehouses over such an electric terminal. The New York Central makes use of a double-deck terminal, separate levels being provided for the through passenger and suburban trains. This is possible only with electrified service.

At the conclusion of Mr. Evans' address he cited and described at considerable length a great many of the electrification projects that have been so far carried out. He described the New York Central, the New Haven, the Long Island and the Pennsylvania projects in and near New York city, the Baltimore and Ohio tunnel, the North Shore and Southern Pacific lines near San Francisco, the electrified roads around London and Paris, electrified Italian roads, and also the recently-planned project for Melbourne, Australia, where 298 miles of track will be electrified ultimately. He concluded with a brief reference to the situation on the Illinois Central Railroad in Chicago.

The discussion of the paper was opened by P. Junkersfeld, who spoke of a number of ways in which the fixed charges of an electrification project can be reduced and how the load factor on the station can be

improved. One suggestion in this connection was that the time of leaving for several competing trains be made different instead of having them leave practically at the same hour. The importance of more frequent and better service on suburban lines that is permissible with electrification is very great in increasing the revenue of these roads.

E. N. Lake said the elements of electrification are very simple. The only element of a steam road as now equipped that is affected by electrification is the steam locomotive, which represents an investment of but five per cent of the total railroad property. He cited Mr. Wilgus' figures on depreciation and fixed charges as being forcible arguments in favor of electrified service. He believes that it is a good thing that there has been the competition between the single-phase overhead and the direct-current third-rail systems on practically similar lines, as it has compelled the manufacturers to perfect their equipment to the highest possible standard and therefore to make it as reliable as can be expected.

James Lyman stated that while electric operation has been regarded hitherto by many as experimental, it is no doubt true that it has passed through these stages, as is shown by the large number of lines already successfully in operation. The standardization of electrical equipment is being achieved to a high degree, as is shown on the various elevated railroads in New York, Chicago, Boston, etc., and on the New York Central and other heavy railroad projects.

It is planned to continue this discussion at the meeting on December 11.

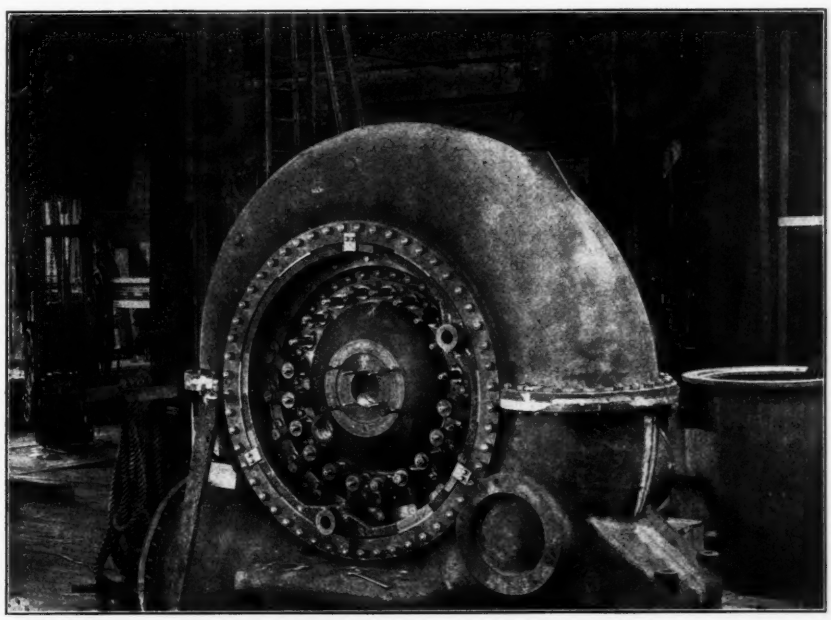
An Electrical Method of Fusing Silica.

The fusing of silica and quartz has been attended with considerable difficulty on account of the high temperature required. A German firm has recently developed an electrical method of fusing silica and molding it into any desired shape. A form of electric furnace is used in which the silica is placed in a carbon tube forming one electrode. This is inserted in a larger tube forming the other electrode and the space between filled with powdered carbon. Current is passed between the carbon tubes and readily causes the fusing of the silica in a perfectly controllable manner. By using an inner core or plug the silica when thoroughly molten can be molded into various shapes.

The Rejuvenation of a Decadent Mining District.

The "bonanza" days of the mining industry are now largely of the past, for men are no longer content to work only the highest "pay dirt" and throw the remainder on the dumps. Now by means of labor-saving machinery and the application of power the mining industry has been reduced to a conservative business proposition which has for its object merely a fair return on the investment actually made.

In order to obtain the best efficiency at least cost it is absolutely essential that cheap power shall be available, whether in coal, oil or waterpower. Without power, working the property is expensive and out of all proportion to the returns.



ALLIS-CHALMERS 5,000-HORSEPOWER HYDRAULIC TURBINE AT THE GUANAJUATO POWER AND ELECTRIC COMPANY'S PLANT, SONORA, MEXICO.

The Guanajuato district of Mexico is an example of what cheap power has done for an otherwise valuable district. What is now one of the most important mining centers in the republic was once hardly a promising proposition. A few years ago the camp was practically dead, most of the large properties having drifted into the hands of a few of the wealthy but inert Mexicans. Two English companies had for years been endeavoring to let go after having made a protracted failure of the attempt to operate in the district, while a few Americans were struggling to save enough bullion out of the low-grade ore to pay the heavy cost of fuel.

Then something happened which transformed the camp into what it is today. It was the advent of a party of Americans with the capital and the courage to build a hydro-electric plant 120 miles away, from which power could be transmitted to the mines.

The hydraulic turbine installed was a 5,000-horsepower Allis-Chalmers single horizontal-type unit in a cast-iron spiral casing with quarter-turn discharge. The waterpower development consists of a diverting dam, a canal five miles long, and two pipe lines, each 3,300 feet long, leading to the waterwheel. There is a cross connection at the power house so that the turbine can be operated from either pipe.

The head under which the turbine operates is 320 feet and the speed is 514 revolutions per minute. The plant was built by the Guanajuato Power and Electric Company, Sonora, Mexico, with Francis O. Blackwell, of New York city, as consulting engineer. The accompanying photo shows the Allis-Chalmers turbine during construction.

Mexican Light and Power.

The English interests in the Mexican Light and Power Company announce they will put through the lease of the company to the Mexico Tramways Company, notwithstanding the fact that the board of directors of the power company has condemned the lease. The English interests now have control of the power stock. The board of directors, which will be forced to resign, includes some of the leading interests in the Bank of Montreal. The English interests are headed by Sperling & Company, of London.

SPUR GEARING ON HEAVY RAILWAY-MOTOR EQUIPMENTS.[1]

BY NORMAN LITCHFIELD.

In the operation of ordinary street-railway motors the gearing is not a serious factor, on account of the low horsepower required, and it is not until the equipment becomes similar in proportions to that of a steam railroad with congested traffic that its importance begins to be felt. With the installation of electric-train service on the Manhattan Elevated Railway in 1901, however, the gearing question forced itself on the attention of the engineers through the large number of failures immediately occurring. On the New York Subway equipments the breakages were still more numerous, for these trains are more powerful than any heretofore used, an eight-car subway express train having motors aggregating 2,000 horsepower, equivalent to a locomotive of about the same power as the new electric locomotives of the New York Central Lines, but differing from the latter in that all the power is transmitted by gears, while the Central's locomotives are gearless.

It is evident that the greatest work done by the gearing on any locomotive is during the period of acceleration, and that for a given mileage the total amount of work done will depend upon the rate of acceleration, weight accelerated per gear, and total number of such accelerations or starts. During the evening rush hours in the New York Subway, the total load per gear is about thirty-five tons, and this weight has to be accelerated at the rate of 1.25 miles per hour per second every third of a mile, that being about the average distance between stations.

How serious a matter the breakage of one gear in the rush hour becomes will at once be realized when we state that at one of the many stub-end terminals of the system thirty-seven trains in and out per hour are handled during the period of maximum traffic. For the purpose of comparison the train movement at the Grand Central Station of the New York Central Railroad may be cited, the maximum number of trains there being thirty-five per hour, and this is, we believe, considered rather extraordinary congestion. One such breakage in the evening rush hour therefore means an inevitable delay to service of half an hour or more and the disruption of the train schedule for the rest of the day, thus entailing great discomfort to the traveling public.

Both the elevated and subway trains of New York are operated by the Interborough Rapid Transit Company, and there is no doubt that the conditions under which these trains operate are unique, further evidence being furnished by the failure of various apparatus other than gears which had proved entirely successful on other roads. We believe, therefore, that the data obtained by this company may be taken as measures of the limitation of power transmission by gearing in railway service.

As is probably familiar to all, the electrical operation of the Manhattan Elevated was commenced some three years previous to the opening of the New York Subway, and our earlier experience was therefore with the equipment for the former. The initial gearing installation on the 125-horsepower motors consisted of wrought-steel pinions and solid cast-steel gears of three-diametral pitch, this pitch being adopted on account of the economical current consumption thereby obtained. The pinions at once began to fail at the rate of about fifteen per month. The failures continuing, it was decided to withdraw all of the gearing then in service and replace it with two-and-one-half pitch, on account of the greater tooth section thereby obtained, although, as before stated, this meant some loss in economy of current consumption. This change practically ended the failure of the pinions, but not entirely of the cast gears, and it was decided that greater reliability could be obtained by adopting a composite type of gear consisting of a cast-steel center on which a wrought-steel rim was shrunk. This combination of a wrought-steel pinion and wrought rim gear of two-and-one-half pitch has proved generally satisfactory for the elevated service, and the improvement to be looked for is therefore in the line of greater wearing life.

On the subway division the motors are of 200 horsepower each and the original gearing equipment consisted of solid cast-steel gears with wrought-steel pinions, diametral pitch two-and-one-half, and teeth of the Brown & Sharpe standard fourteen-and-one-half-degree involute. As on the Manhattan division, so on the subway, it soon became evident that the design was not proper, but in contrast to the elevated road it was the gears which first caused the trouble. The cast-steel gears, therefore, were all scrapped and replaced by the wrought-rim type.

This improvement practically ended the gear breakage, but unfortunately the pinions began to go, the breakages averaging over one a day, and, furthermore, we find it unsafe to run a pinion the teeth of which measure less than three-sixteenths inch at the top. We are, therefore, compelled to scrap material which should be available for wear.

To what, then, shall we look as a remedy? Three suggestions have been advanced by the gear manufacturers:

a. Diametral pitch less than two-and-one-half.

b. Steel with elastic limit of 90,000 pounds per square inch and over, as compared with our present 45,000.

c. Twenty-degree stub teeth.

The first suggestion we are unable to accept on account of some local conditions, but the combination of the other two seems to have possibilities of success. and we are now replacing all our gearing with specially treated carbon steel with stub teeth. Let us now consider the loads the teeth have to carry and determine why it is that we have to resort to the use of special designs and material in order to make our gearing stand up.

Fig. 1 illustrates an express run in the subway, giving the power consumption per train of eight cars, five of which are motor cars, each carrying two motors, thus making ten gears per train. On the same diagram curves are platted showing the fiber stress in a standard fourteen-and-one-half-degree involute and a special twenty-degree involute tooth, both worn to our present limit of three-sixteenths inch at top of tooth. The force acting at the pitch line of the tooth has been figured from the power-consumption curve and the motor.

Referring to the diagram, it will be noted that the worst condition occurs just at the commencement of the motor curve, this being the point at which the gearing is transmitting the maximum torque at the greatest speed obtained during the period of acceleration, the maximum torque occurring, of course, only during this period. Under the conditions shown the fiber stress at this point is 13,370 pounds per square inch in the standard fourteen-and-one-half-degree involute tooth, and at this instant the train is running at 17.3 miles per hour, with a corresponding gear speed of 1,168 feet per minute. On account of this speed, therefore, we require a material which will permit the use of a safe working stress at no speed, equal to 39,400 pounds per square inch. The elastic limit of the material

[1]Abstract of a paper presented at the annual meeting of the American Society of Mechanical Engineers, at New York, December 3.

we have had heretofore runs about 45,000 pounds per square inch, and we therefore have a factor of safety of only 1.1, which is obviously low.

In these calculations we have considered the elastic limit of the material rather

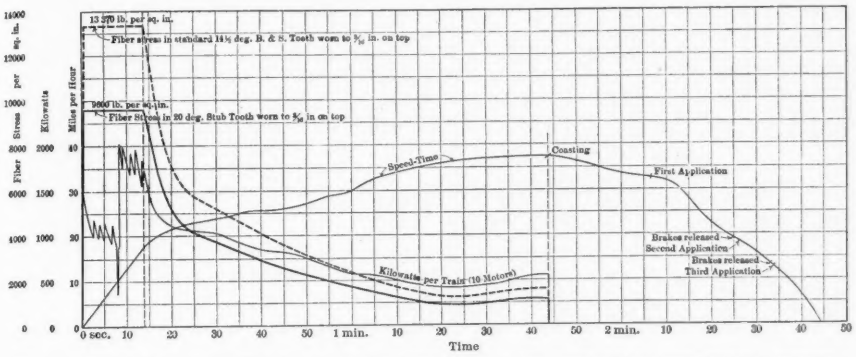


FIG. 1.—STRAINS IN TEETH DURING EXPRESS RUN—SUBWAY DIVISION, INTERBOROUGH RAPID TRANSIT COMPANY, NEW YORK CITY—CALCULATED BY LEWIS METHOD.

than the ultimate strength, on account of the dynamic character of the load, each pinion tooth receiving nearly 1,800 blows per mile. The greater the ratio, therefore, between the fiber stress and the elastic limit of the material (the other physical properties remaining of proper value), the greater the life, and some relief should therefore be obtained by the adoption of the special twenty-degree stub tooth which reduces the fiber stress nearly thirty per cent and increases the minimum factor of safety from 1.1 to nearly 1.6.

A much greater relief, however, may be looked for by the use of steel with a high elastic limit, say, 90,000 pounds per square inch, which, used in conjunction with a design of stub tooth, increases our minimum factor of safety to 3.2 as compared with our present 1.1.

It will be noted that the foregoing calculations are all dependent upon the use of the Lewis formula, the fundamental assumption of which is that the teeth bear across the whole face. Consideration, however, must be given to the fact that in practice it is not possible always to maintain perfect alignment between gear and pinion on account of the necessarily rough design of the motor and its assembly on the truck. The effect of this disalignment is shown in Fig. 2, which is a photograph of a pinion which broke in service. In this the lower half of the teeth have been battered over by the loose piece jamming between the gear and pinion. It is the upper half of the teeth which cracked, however, showing that these cracks were not caused by the jamming of the loose piece, but by the gradual hammering of the pinion against the gear in service. The points gave away successively, until at last the loose piece was caught and ripped out, and we find this typical of all the failures. The break ordinarily starts at the inner face of the pinion, due to the natural tendency of the armature to cock that way, but in some cases it starts at the outside, probably caused by running a new pinion with a gear which had previously worn taper.

Furthermore, the breakages cannot be attributed to so-called crystallization or

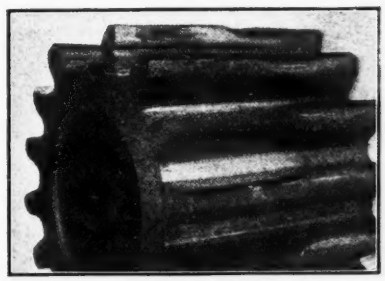


FIG. 2.—THREE-QUARTER VIEW OF PINION, SHOWING CRACKED TEETH.

"gradual fracture," for in many instances the teeth are practically new having broken after inconsiderable mileage. The necessity of having a high ratio between the theoretical working stress and the elastic limit thus becomes evident and justifies us in the adoption of the special

FIG. 3.—SUGGESTED FORM OF TOOTH.

means we have described to overcome the abnormal failures.

The lack of alignment of gear and pinion above mentioned is probably one of the chief causes which necessitated the use of these special means, and we have therefore endeavored to find some other method of overcoming the difficulty. This led to the suggestion that as we are actually obtaining only a short bearing on the tooth, it would be better to assure this bearing being at the center of the face rather than at the end, which might be accomplished by the use of a tooth something as shown in Fig. 3, in which the central portion is left the standard outline and the balance tapered off both ways toward the ends. No investigation has been made as to the practicability of cutting such a tooth or of its desirability, and it is suggested for consideration merely as one possible way of compensating for the lack of alignment occurring in railway-motor gearing.

Electric Tramways in Germany.

United States Consul-General Richard Guenther writes as follows about the electric tramways of Frankfort:

The Frankfort electric-tramway lines at the close of the fiscal year (1907) had a length of thirty-eight English miles and carried during that year 74,250,000 passengers. There are 612 cars for the passenger service, and the total number of employes is 2,124. As most of these are married, the Frankfort tramway service furnishes means of living for about 10,000 people. On an average the electric cars run over 30,000 English miles per day. During the great International Turner festival last July the number of miles run on some days exceeded 60,000. Though the fares are lower than in American cities (ordinary fare is ten pfennigs, not quite two and one-half cents), yet the net profit derived from the service turned into the municipal treasury was 1,315,000 marks ($312,970). The profit realized during the year by the city from its electric lighting and testing plant aggregated $400,200.

The stride tramway travel has taken in Frankfort in the last decade can be discerned when comparing the above statistics with those of 1897, when the city bought out the then-existing horse-car lines which belonged to a Belgian joint-stock company. Then the total length of line was nineteen and one-fourth miles, number of cars 197, which carried during that year 26,500,000 passengers and covered a running distance of 3,375,000 English miles.

A new high-speed trolley line is to be built from Boston to Beverly at a cost of $11,000,000, to be known as the Boston & Eastern Railway. A 7,200-foot tunnel is to be built under the harbor at Boston costing $2,750,000.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

THE COST OF OPERATING ELECTROBUSES.

The London Electrobus Company, Limited, has recently issued a subscription circular asking the shareholders of the company to contribute $250,000 to a new issue of stock. A letter accompanying the prospectus gives some interesting figures dealing with the cost of operation. The company started service with six buses, in July, 1907, and in the first three months 179,909 passengers were carried. In the three months from July 15 to October 15, 1908, 925,959 passengers were carried. Over a period of fifteen months, from July, 1907, to October, 1908, the average number of passengers per bus has been nearly eleven, and the earnings about twenty-eight cents per bus-mile. In connection with the maintenance of storage batteries, it is stated that, with the exception of a few experimental batteries, the entire battery maintenance has been done under contract at four cents per bus-mile; that these contracts are still in force, and that offers have been made to maintain 100 electrobuses at the same rate for three years. The statement issued by the company's auditors makes it appear that the earnings during the first twelve months exceeded operating expenses by $3,714.54. This fell short of the establishment and overhead expenses. For the three months, July, 1908, to October, 1908, the earnings exceeded the operating expenses by $7,632.18, which is about sufficient to pay the establishment and overhead expenses. These expenses, it is stated, would not be materially increased if the number of buses were doubled, and the experience of the company indicates that as the number of carriages has been increased, the takings per bus-mile have also increased. From the auditors' statement it is found that for the year ended July 15 the number of passengers was 1,596,831. The total receipts were $43,638.18. The average receipts per bus-mile were 27.6 cents, and the total operating expenses were $39,923.64. For the three months ended October 15 the total income was $25,034.20, and the income per bus-mile 28.76 cents. These figures do not include provision for establishment, supervision or head-office charges, nor repairs to buildings. The total of these, excluding depreciation, for the same three months, was $7,582.89.—*Abstracted from the Electrician (London), November 20.*

THE MANUFACTURE OF METALLIC LAMP FILAMENTS.

In the present installment of this serial, which has been previously referred to in these columns (ELECTRICAL REVIEW, November 21), Engineer B. Duschnitz describes the arrangement employed by Gebrüder Ruhstrat, of Goettingen, for manufacturing metallic filaments. The object of the arrangement is to lead the filament, consisting of wolfram oxide, for instance, through a furnace heated to about 2,000 to 2,700 degrees, and put it through the complete fusing process therein, and when it has passed through the furnace and is still aglow and flexible, to wind it on a spool provided for this purpose or cut it into definite lengths. By the aid of suitable means the filament can also be wound directly on frames to be inserted in lamps. The arrangement is diagrammatically illustrated in Fig. 1. P is a filament press, W an electric furnace, G an enclosure, through which hydrogen is made to flow and which contains the furnace and winding device, and L and L' are conductors leading the current to the electric furnace. The method of manufacturing the filaments is as follows: The press P is filled with wolfram oxide paste and a thin filament F is pressed from it, led through the hot furnace W and wound on the spool R or a frame, or else cut into definite lengths. The case G protects the entire arrangement from the air and is filled with an indifferent gas, as hydrogen, which is injected at H and withdrawn at A. If very thin filaments are to be pressed, the auxiliary cylinder E is filled with a suitable binding material, which is pressed through tube D into the space T, where it covers the filament issuing from press P, in order to give it greater strength before it is fused. The furnace is of special construction. The heating body *k* (Fig. 2) is a carbon tube cut lengthwise into a spiral of a pitch of about ten millimetres. The space *r* is filled with heat-resisting material consisting of 100 parts of coke, eighty parts of sand and twenty-six parts of table salt. This mass is enclosed in a protecting covering *m*. The space *r'* is filled with a mixture of magnesia and carbon, and a second covering *m'* surrounds the entire furnace; *m* and *m'* consist of asbestos. Metal plates *a a* are provided for attaching the electric conductors. According to Ruhstrat's statements the filament is moved through the furnace at the rate of two millimetres a second. The arrangement would thus be capable of manufacturing a filament 7.2 metres long in an hour, sufficient for about twelve lamps of 100 volts and twenty-five candlepower.—*Translated and abstracted from Elektrotechnischer Anzeiger (Berlin), November 8.*

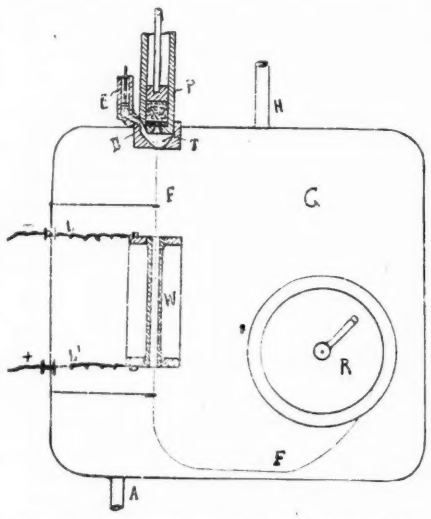


FIG. 1.—PROCESS OF MAKING METALLIC FILAMENTS.

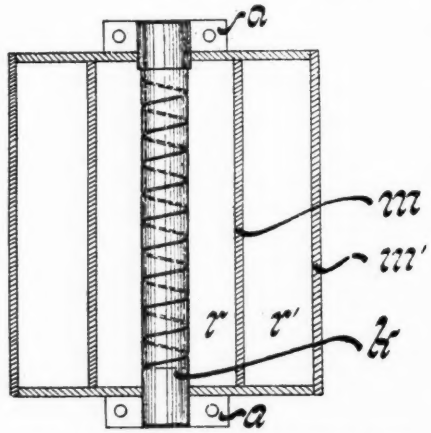


FIG. 2.—ELECTRIC FURNACE FOR THE MANUFACTURE OF METALLIC FILAMENTS.

THE ELECTRICAL INDUSTRY IN ENGLAND AND ABROAD.

For the topic for his presidential address before the Institution of Electrical Engineers of Great Britain, on November 19, W. M. Mordey made a comparison between the condition of the electrical industry in England, as indicated by statistics of returns relating to electricity supply, with the electrical industry in other countries, particularly in Germany. He took exception to the repeated statements that England was in a backward condition as compared with other countries in respect to practical application to the industrial and social requirements of the nation. As a basis for comparison, Mr. Mordey said that it was necessary only, so far as the service of the public is concerned, to find the extent to which the systems of supply of electrical energy in different countries provide for the requirements of the public; in other words, to find the average consumption in units per inhabitant, and the average price per unit actually paid. Tables giving this information for a large number of towns in England and abroad, particularly in Germany, based upon what are essentially authoritative data, were examined, and this information supplemented with particular references furnished in response to his own applications. Mr. Mordey concludes that in the large towns in Germany electrical energy costs twice as much per unit, and the consumption per inhabitant is half as much as in the large English towns. In the medium-sized towns, the price in Germany is thirty-three per cent higher than in England, and the consumption is about the same as in the medium-sized English towns. In the small towns in Germany the price is forty per cent higher, and the consumption about the same as in England. The public generating stations contain two-and-one-quarter times as much power per inhabitant of the whole country as those of Germany. In electric-tramway work England does not compare unfavorably. Only where the advantage of cheap and ample waterpower in a few places has enabled an extensive supply to be given at low prices, notably in Lyons, Geneva and Grenoble, does any advantage exist. But in this direction also a British town, Bolton, with an average of 2.36 cents per unit, has the cheapest supply. Mr. Mordey considers that there is nothing in British electrical work to justify in any way the charges that have been made against it. The alleged backwardness does not exist. The country is ahead, and well ahead. There are hindrances, legislative and otherwise, to going still further ahead, but there is no more justification for the statements about scientific and technical education being behind other countries than for the statements about the backwardness of British electrical engineering. Technical education should be judged, not by the wealth of the equipment of laboratories, but by the engineering results achieved in the country.—*Abstracted from Electrical Engineering (London), November 26.*

ALTERNATING-CURRENT TELEPHONY.

Attention is called by the author, August Maior, to the importance of alternating currents in telephony over lines of any length. While engaged in experiments on the application of alternating currents to multiple telephony, he observed that, in general, the speaking currents superimposed on the alternating currents are of a more complicated form and are not an exact reproduction of speech. The rattling and long-drawn sounds assume more nearly their natural character the closer resonance is approached. The frequency of the currents employed is of great influence on the clearness of speech, and a perfectly clear reproduction of the sounds is attained only when a frequency is used which no longer audibly affects the diaphragm of the telephone receiver. The intensity of the sounds is also greater with the higher frequencies. But if, eventually, a microphone which is in series with another self-inductionless resistance, is connected in parallel with the self-induction coil of the resonating alternating-current circuit, very great variations in the strength and period of the alternating current may be produced by slight changes in the suitably-chosen parallel resistance without self-induction. In this manner the problem of the telephone relay can be most easily and most naturally solved. If the alternating current is in resonance, the speaking currents superimposed on it are virtually also in resonance, and in this way the injurious influence of self-induction and capacity of lines of any length can be easily removed, the damping constant being diminished as much as possible without impairing the strength of the transmitted sounds, which may even be increased, as before indicated. This is not always possible by the insertion of Pupin coils in the line, as is well known.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), November 19.*

ALUMINUM AS A CONDUCTOR IN THE ELECTRICAL INDUSTRY.

In Great Britain the employment of aluminum as a conductor has not had much vogue, though in the United States it has been used to a great extent for some time. The Niagara, Lockport & Ontario Power Company uses an aluminum transmission line from Niagara to Syracuse, a distance of 162 miles; while the Standard Electric Company, of California, has an aluminum transmission line 200 miles long. That aluminum has not been used to a greater extent in Great Britain is not altogether a matter for surprise. In the first place, there is the well-known British inertia to be overcome, while, owing to the meagre adoption of overhead work for public supply, it has hardly received proper consideration. The question whether it can be economically used for cables is an interesting one, comprising many interesting factors. During the past two years the price of copper has fluctuated between $560 and $270 per ton. Though to some extent disturbed by this variation, consequent on a demand which the manufacturers were not able to meet, aluminum is now available in any quantity, and its price has been reduced, until today it is quoted at the same price per ton as copper. As, however, for equal conductivity, only half the weight of aluminum is required as of copper, a net saving of fifty per cent on the cost of the raw material is effected by employing the former metal. In the installation at Snoqualmie Falls, where 12,000 horsepower is transmitted by aluminum conductors, some thirty-two miles to Seattle, and forty-four miles to Tacoma, in the state of Washington, the spans between the poles vary from 120 to 150 feet. From Electra to San Francisco, in California, the poles are about 130 feet apart, and the distance over which power is transmitted is 154 miles. The maximum span reached by aluminum conductors is 2,192 feet, across the Niagara River.—*Abstracted from the Electrician (London), November 27.*

Dr. Steinmetz to Lecture in Chicago.

At the special invitation of the Chicago Section, American Institute of Electrical Engineers, Dr. Charles P. Steinmetz will deliver a lecture on "Light and Illumination" at 8 p. m. on December 17, in Fullerton Hall, Art Institute. All members of the Chicago section, as well as the local branches at Armour Institute of Technology and Lewis Institute, are urged to attend and bring their friends with them.

INDUSTRIAL SECTION

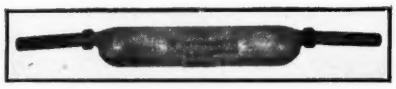
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A Linemen's Protective Shield.

In these days when every effort is being made to safeguard life and limb, the introduction of a shield which will minimize the dangers to linemen working on live high-tension circuits attracts considerable attention, and is worthy of specific illustration and description.

The shield which is being manufactured by the Linemen Protector Company, 201 Whitney Building, Detroit, Mich., is one of the most useful devices which has been developed in recent times. The accompanying illustrations show the protective shield and the method of using it on high-tension circuits. The shield is made of pure Para rubber, no reclaimed rubber being used. The pure rubber is carefully washed and processed so as to eliminate any possibility of impurity either in the form of sand or metal, as before the completed shield leaves the factory it must withstand very high pressures in the molding process, and a puncture test of 30,000 volts, alternating current, under water.

The main portion of the shield is made of three-eighths-inch rubber, tapering down at those extremities which are least required for insulating value to three-sixteenths of an inch. In order to give the shield sufficient rigidity and to make it tend to hold its original shape and fit closely over the insulators and wires, heavy strips of raw canvas are crisscrossed, and this method of laying up the canvas strips also avoids the possibility of puncture from a tool or from the lineman's spur.



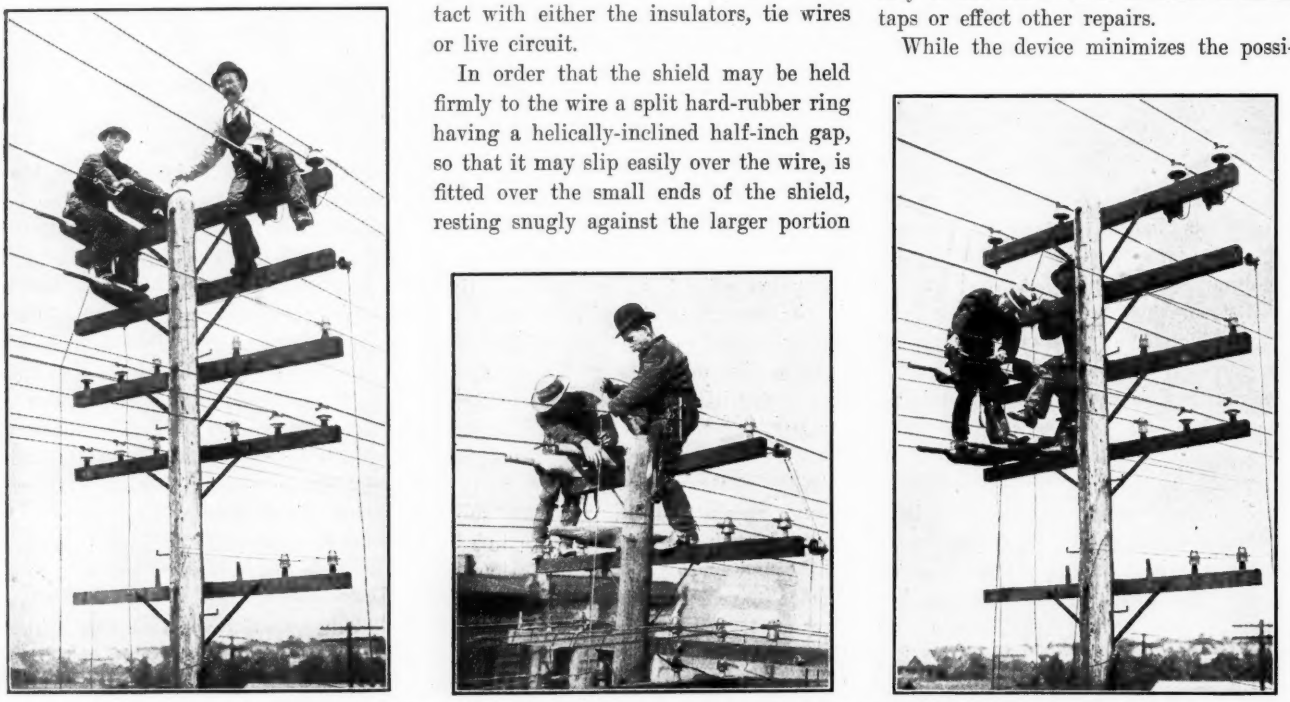
THE LINEMEN'S PROTECTIVE SHIELD.

In using the shield it is hoisted from the ground, weighing complete only seven-and-one-half pounds to eight pounds, and is gripped by means of soft-rubber handles attached to the lowermost outside point of the bifurcated apron. This keeps the wireman's hands from possible contact with either the insulators, tie wires or live circuit.

In order that the shield may be held firmly to the wire a split hard-rubber ring having a helically-inclined half-inch gap, so that it may slip easily over the wire, is fitted over the small ends of the shield, resting snugly against the larger portion of the shield. While this slips on and off easily by a smooth, even movement, any tendency to jerk it off causes it to grip the shield very tightly. This is a great advantage, because at times the lineman will stand on one shield which may be placed over a cross-arm and wire lower than the point at which he is working. Should he slip and the heel of his boot come in contact with the split ring it will immediately check the slipping, and will form a brace for his foot.

The shield is recommended by the manufacturer for use on all live circuits not exceeding 7,500 volts. It is in use, however, on circuits as high as 10,000 volts. In wet weather it is not desirable perhaps to use the shield on circuits carrying voltages higher than 4,600, as in this case the static leakage over a wet shield might give the lineman sufficient shock to throw him off his balance and into contact with an unprotected live wire, or possibly cause him to fall to the street. It is stated that it is a fact that the shields have been used on 4,600-volt, three-phase circuits under all weather conditions, and that with their use it has not been necessary to cut out circuits in order to make taps or effect other repairs.

While the device minimizes the possibility of unintentional contact with other wires on the same pole, there is the chance that the lineman may rely too much upon the protective quality of the shield and subject himself unnecessarily to danger from live wires. Where the shields have



VIEWS SHOWING THE LINEMEN'S PROTECTIVE SHIELD IN USE ON HIGH-TENSION LIVE WIRES.

been adopted, however—and they have been by a number of large companies in several sections of the country—it has been found that the linemen have accepted them in the same spirit as they have accepted climbing spurs and heavy belts, and other protective devices. It appears that the older and more experienced the lineman is, the more readily does he adopt the protective device; and its utilization appears also to be an indication and a warning on the part of the company that the circuit to be protected is dangerous, and that the lineman, in addition to utilizing the safeguard provided, must also exercise that care which is necessary to eliminate the possibility of danger to himself.

The accompanying illustrations, showing the shield in use, were made from photographs taken during work on live circuits carrying 4,600 volts, three-phase. An affidavit is in the possession of the manufacturer, stating that current was on all three wires shown covered by the shield, and that it was not shut off during the time the pictures were taken or while the work was being done.

Intercommunicating Telephone Systems.

In the December issue of the *Everbest Magazine,* published by the Ewing-Merkle Company, St. Louis, Mo., A. R. Forse, manager of the telephone department, gives some interesting information concerning intercommunicating telephone systems.

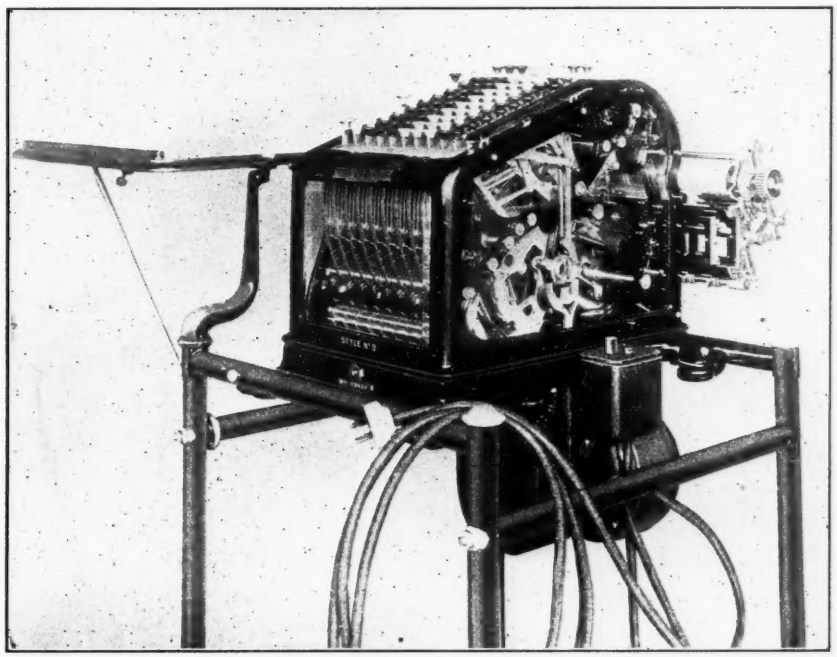
The installation of a good intercommunicating telephone system is somewhat more expensive in first cost than a private branch exchange would be, but the first cost is practically the only cost in the intercommunicating system, with the exception that about every six months there should be a new set of batteries installed, so that the service may be first class in every particular. Junction boxes should always be used wherever a cable is to be spliced. Where it is necessary to cross from one building to another, or through sections of the same building that are damp, weatherproof wire should be used; but where the lines run through ordinarily dry places, annunciator cable having a weatherproof tape and a braid overall may be used. Cable in which each wire has a distinctive color covering is preferable, and saves time in testing. Most of the systems now use four battery wires—two for the ringing batteries, and two for the talking batteries—and one wire for each station installed. Thus, a system having ten telephones would have a cable containing fourteen wires. The battery wires are usually several sizes larger than the others. For systems in which not more than 300 or 400 feet of cable is used, battery wires of No. 18, and line wires of No. 22 are generally used, with slightly heavier wires for longer distances, using four batteries on the talking wires and six on the ringing wires.

An Electric Motor-Driven Adding Machine.

Everyone has experienced the feeling of disgust caused by the expenditure of time and energy in the actual performance of long arithmetical computations necessary to obtain a desired result. Being compelled to devote close attention to a series of operations, which in themselves are extremely simple and require comparatively little intelligence is, to say the least, irksome. Then as the latter feeling increases, the liability to error becomes greater, until there is a definite limit to the amount of such work which may be done by a single computer.

The pertinence of the expression, mechanical computation, is evident when it is considered that this can actually be performed by mechanical computers, or "adding machines"; it has been stated that the number and complexity of the arithmetical operations which can be thus performed are only limited by the mechanical difficulties in the construction of the machine, which increase very rapidly as the number of possible operations is increased. The higher faculties of the human mind can never be replaced by a mechanical contrivance, but in large part the purely calculating power may. Oliver Wendell Holmes remarks that "the calculating power alone should seem to be the least human of qualities, and to have the smallest amount of reason in it, since a machine can be made to do the work of three or four calculators, and better than any one of them."

The ordinary form of adding machine will do adding, subtracting, multiplying and dividing from four to six times as fast as an expert. It is not possible to make errors in the actual performance of the computations, and during operation it does not require the close attention which the human computer must necessarily give his work. By its use, in connection with the card systems and other short cuts devised for especial use with the machine, the efficiency can be much increased. The only mechanical work necessary is the pressing of the keys and the operation of the handle projecting to the right of the case, and the latter has been eliminated in the improved forms by the application of the electric motor.



MOTOR-DRIVEN ADDING MACHINE.

The illustration shows perhaps the most popular adding machine, the Burroughs, equipped with a Westinghouse motor. With this improvement the number is written without any mechanical labor by simply pressing a key on the keyboard of the machine, which throws in a clutch and connects the shaft of the motor with

that of the handle. When it is considered that the manipulation of the handle is the only thing in the operation which is tiresome and that this causes a material interruption of the work, it will be seen that the application of the electric motor is a very material advantage. In fact, experiment has shown that the operation is forty per cent faster, with less liability to error caused by setting the incorrect number and less labor on the part of the operator when the machine is thus driven.

The motors used with this adding machine have capacities of one-tenth or one-eighth horsepower, the former being used with a machine of seven figures and the latter with one of nine figures. They run at a speed of about 1,200 revolutions per minute, and are furnished for either direct or alternating current. The cost of the operating energy is insignificant, varying from one to two cents an hour, according to the local rates for electric energy. No special wiring is necessary, the motor can be connected to an ordinary lighting circuit as readily as an incandescent-light bulb. The motor will run continuously without attention, an occasional oiling once in several months being only necessary.

Western Electric Company Completes Paris Switchboard.

The replacement of the destroyed Paris telephone switchboard, as described and illustrated in the issue of November 21, was completed according to specifications November 30 and the $600 daily penalty clause in the contract, for every day over sixty days required in building this switchboard, was thus rendered inoperative.

The Chicago plant of the Western Electric Company started work on the big switchboard October 3, shipped it to New York on October 23, and it arrived in Paris on the steamship La Provence November 6.

This is the second record made within a year by the Western Electric Company for rapid telephone-exchange replacement; the other being that of the Antwerp exchange—the oldest in Europe—for which a 5,000-line equipment was manufactured and installed in thirty days. The Paris contract covered a 10,000-line equipment and, while apparently involving but twice the labor of the other, in reality meant several times more. The fast time made stands as another triumph for American skill and enterprise.

PREVENTING THEFT OF CURRENT.

BY H. W. YOUNG.

Theft of current with the many and varied methods by which it is practiced, presents a most interesting, as well as harassing, problem to central-station

FIG. 1.—SERVICE PROTECTED.

companies, many of whom have perhaps not given the subject the consideration or attention which its seriousness demands.

The larger electric-lighting companies are giving this subject careful thought, and large sums of money have been recovered in some cases, but only by an

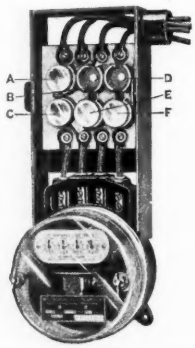


FIG. 2.—TESTING OR INSPECTING SERVICE.

elaborate and expensive spy and detective campaign. That such a system, entailing as it does large expenditures, is justified by the results which have been obtained, many of the companies will testify.

The central-station man, familiar with the fact that the majority of those who will steal current are of the class whose credit involves a deposit before the installation of the service, will appreciate that the list is not, however, entirely confined to this class. A man will hesitate before he will deliberately remove the insulation and make a permanently illegal tap on a service wire, but few will hesitate to connect a flexible cord to an exposed branch block or service switch, when it is necessary to have temporary illumination in some obscure corner, and which will probably prove to be so handy as to remain permanent. Also, but few will hesitate to connect a discontinued service to the branch block when for any reason they wish light, and it is not otherwise instantly available.

A surprisingly large number of connections of this character have been discovered in apartment houses, where meters are removed during the summer months, and the electric-lighting company is not able to connect the service as rapidly as desired.

The average central-station man, with a broad and abiding faith in human nature, will ponder over unaccounted-for current losses, and wonder how much the human equation is a factor in the phenomena of current transmission, particularly so as it has been discovered that the curve of current losses flattens materially in feeders, the service wires of which are carried in conduit directly into the meter, with entrance box and meter connections protected by seals that successfully serve their intended purpose.

The problem is not how to apprehend people who are stealing current and bring them into court, but to remove temptation, increase metered output, and eliminate legal complications that add very greatly to a station's cost of production and frequently engender a hostile feeling in a community which really does not understand the facts of the case.

Appreciating the need of coping with this phase of central-station trouble, the Central Electric Company, Chicago, and the Pettingell-Andrews Company, Boston, have marketed a number of devices designed to cure this evil, one of the best known being the "O. K." connection block illustrated in Figs. 1 and 2.

Where it is desirable and practicable to carry the service wires in conduit this connection block offers a means of terminating the conduit at the meter and taking the wires into and out of the meter without leaving any exposed leads or connections. The enclosing box is so made that line and load wires may be brought in on either side as desired. It fits snugly against the meter, protecting one or more of its supporting screws, so that it is impossible to disturb the meter connection or remove the meter from the wall without breaking the seals of the connection block cover.

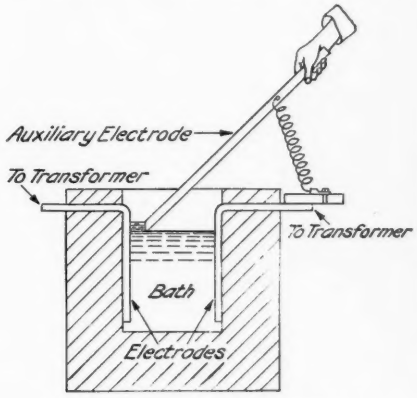
In the view showing the connection block with the cover removed, the screw plugs designated by various letters are not necessarily fuse plugs, but switch-

connecting means, which enable the inspector to make any desired test on the meter without cutting a wire, opening a taped joint, or interrupting the customer's service. By screwing the connection plugs into receptacles B, D, the meter is by-passed and the customer's lights kept burning. Removing the plugs ACEF entirely disconnects the meter from both load and line and permits its removal or replacement without the necessity of a soldered joint or any tool other than a screwdriver.

Any desired commercial or house test can be made by means of this connection block, and its use in laboratory work greatly facilitates meter testing, etc., because of the facility with which any desired connection or combination of connections may be made. This particularly applies to the testing of one or more meters in connection with a standard where it is desirable to remove a meter from its connection without disturbing the others.

A New Electric Furnace for Annealing and Tempering.

To secure the best results in the process of annealing and hardening, it is necessary to have a constant temperature in the furnace. The coal and gas furnaces of today do not entirely fulfill this requirement on account of the large furnace area exposed to the air for radiation.



SECTIONAL VIEW OF ELECTRICAL FURNACE FOR ANNEALING AND TEMPERING.

Again, to obtain the best results, it is often necessary to adjust the temperature of the furnace, and this cannot be done with precision with the gas furnace. Realizing these facts, it is natural that tool producers and manufacturers in general should look forward to the day when a hardening furnace would be designed that might assure them better results in a shorter time than is possible with present methods.

In the new type of electric furnace now being manufactured by the General Electric Company, Schenectady, N. Y., for operation on alternating-current circuits, metallic salts are reduced to a liquid state by means of an electric current. It can be readily seen that as soon as these salts reach a liquid condition, the temperature can be easily regulated by varying the amount of current passing through the bath. By this method of regulation any temperature from 250 to 1,350 degrees Centigrade may be obtained. The temperature will remain uniform throughout the bath except at the surface, where it is slightly lower, due to radiation. This applies, however, only to a depth of 0.6 to 0.75 inch.

Herewith is shown an electric-furnace outfit as it is installed in the die department of the Schenectady works of the General Electric Company. The outfit, as can be seen, consists of the furnace, with its hood suspended from above; the regulating transformer with regulating switch; the switchboard with the necessary ammeter and voltmeter; the incoming line with fuses. The regulating switch is provided with a sufficient number of contact points to give, as stated

ELECTRIC FURNACE FOR ANNEALING AND TEMPERING.

before, almost any desired temperature between the limits of 250 to 1,350 degrees Centigrade.

The furnace, a sectional view of which is also shown, consists of a fire-clay crucible, surrounded by an insulating material, usually of asbestos, which rests in a fire-clay box; all being supported by an enclosing case of iron. Two suitable electrodes, connected to the low-tension side of the transformer, are placed on each side of the crucible, and are in direct contact with the bath at all times.

To start up the furnace an arc is started across the broken flux by means of an auxiliary electrode, and in a very short time the solid mass is in a molten condition. After the bath has reached its proper temperature, that portion of the material to be hardened is placed entirely in the liquid bath, and is allowed to remain there until it attains the same color as the bath, when it is removed and tempered in water or oil, as the case may be.

The bath for hardening or annealing completely fills the crucible, and in the Schenectady factory consists of equal portions of barium chloride and potassium chloride. The ultimate temperature depends on the relative proportions of the two chlorides, the higher the percentage of barium chloride, the higher the temperature may be carried.

In addition to hardening, the furnace may be used for softening tempered steel, the bath being maintained at a temperature of about 250 degrees Centigrade for this work.

In summing up the advantages of this type of electric furnace, the following may be mentioned: There is no chance for oxidation, for the material while being heated does not come in contact with the air. All parts of the tool are subjected to the same degree of heat at all times, thus prevnting any possibility of strains or overheating. Its high efficiency and low cost of operation place it far above the gas furnace. There is practically no danger from fire, as the outer walls of the furnace are never hot; in fact, when the bath has a temperature of 1,300 degrees Centigrade, the hand can be placed on the outside of the furnace without being burned. It is so simple and requires so little care and attention that it can be operated by an ordinary workman. The metallic salts have no effect on the composition of the steel, and the operator never comes in contact with dangerous fumes, as in the cyanide bath.

In the manufacture of machine tools, automobiles, razors, knives, firearms, jewelry, fine instruments, etc., this electric furnace bids fair to replace almost every other type of furnace that is called upon to meet the requirements of accurate tempering, according to the manufacturers, who have made thorough and practical tests of this apparatus.

Keystone Horizontal Edgewise Switchboard Instruments.

The Keystone Electrical Instrument Company, Ninth Street and Montgomery Avenue, Philadelphia, Pa., has placed on the market a new line of horizontal edgewise switchboard instruments. These are made in voltmeters, ammeters and wattmeters, for both direct and alternating-current circuits, and have been designed with particular reference to lighting and power switchboards where space is limited. They are secured to the board by the current-carrying lugs, so that only two holes need be drilled for voltmeters and ammeters, and four holes for wattmeters.

The instruments are neat and pleasing in appearance, and are mounted in plain cases. All cases are finished in dull black, this finish wearing indefinitely and requiring no attention beyond an occasional wiping with a soft cloth to remove dust. The scale openings are large, admitting ample light for reading at a distance. The

KEYSTONE HORIZONTAL EDGEWISE DIRECT-CURRENT VOLTMETER.

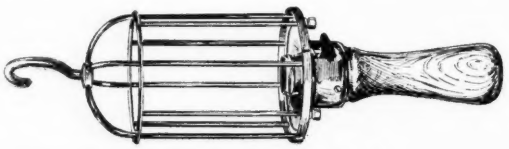
form and location of the pointer are such that readings can be taken at a considerable angle without introducing appreciable parallax errors.

Voltmeters and ammeters for direct current are built on the Deprez-D'Arsonval system; voltmeters and wattmeters for direct and alternating current, on the electrodynamometer system; and voltmeters and ammeters for alternating current on the electromagnetic system. Wattmeters for alternating current are made for either single or polyphase circuits.

"Bulldog" Portable Lamp Guard.

For work requiring the use of an electric lamp in places where the globe is likely to be injured by the light falling or being struck by hard, heavy objects, some protective cage or guard is a necessity. In the design of such a guard it is essential for the comfort of the workmen that the guard metal be insulated from contact with any live parts in the socket.

Illustrated herewith is the "Bulldog" portable lamp guard, which is rigidly made, of Bessemer steel, copper-plated. The socket is provided with a key, and the handle gives perfect insulation. The bushing is large enough to take any size cord, and the guard will contain either a sixteen or thirty-two candlepower lamp.



"BULLDOG" PORTABLE LAMP GUARD.

The guard is strong enough for the heaviest usage around engine rooms, machine shops, roundhouses, etc.

The Bulldog portable lamp guard is manufactured by the Crescent Company, 103 West Adams Street, Chicago, Ill.

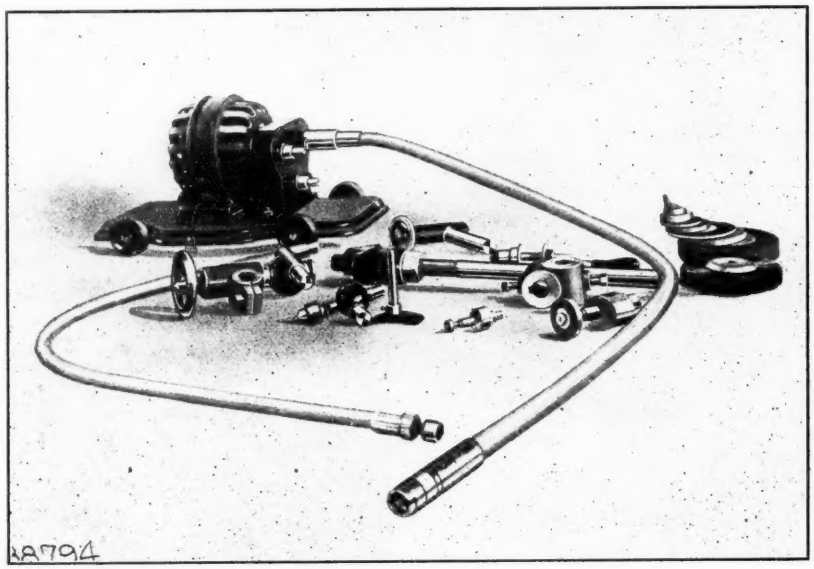
Small Motor-Driven Emery Wheels, Buffers and Drills.

The illustration shows a handy motor-driven flexible-shaft outfit furnished the United States Government by the Coates Clipper Manufacturing Company, of Worcester, Mass. The equipment consists of a breast drill, drill press, emery wheels and polishers, and is provided with such necessary attachments as a multiplier, clamp, spindle, old-man, etc. The motor is a one-horsepower Westinghouse type CCL alternating-current motor mounted on a portable truck, and fitted with speed-changing head and flexible shaft. The portability makes the appliance convenient for any large work, and the flexible shaft permits the operator to work with ease upon parts otherwise accessible with difficulty.

In order to obtain the proper cutting speeds for emery wheels of different diameters, multipliers of the proper ratios are used. The two which can be used to best advantage are those having ratios of eight-and-one-half to one and six-and-one-half to one, respectively; the former for use with three-eights, one-half and one-inch wheels, and the latter for two and three inch wheels. Larger sizes are used on a clamp spindle, which runs at the speed of the shaft, 1,800 to 2,500 revolutions per minute.

By removing the breastplate on the drill and attaching a combination old-man, drilling up to one-half inch can readily be done. Larger drills up to one-and-one-fourth inches are used in connection with a worm-feed drill press and old-man attachment.

The outfit is so arranged that a heavy or light shaft can be used, according to the requirements of the work. The smaller shaft is fitted with a taper end sleeve for taking small tools, and the larger shaft has a clutch sleeve and grab-dog clutches, so that one tool can be used after another without making any change in the shaft.



SMALL MOTOR-DRIVEN EMERY WHEELS, BUFFERS AND DRILLS.

Edison Phonograph Manufacture.

Announcement has been made at the works of the National Phonograph Company in West Orange, N. J., that the manufacture of Edison phonographs is in future to be restricted by the company entirely to West Orange, and that the industry will be withdrawn from the London, Paris and Berlin factories.

Current Electrical News

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, NOVEMBER 28.—A very successful interurban electric road has been installed between Schaffhausen and Schleitheim. It uses a type of motor car operating at 750 volts, direct-current, and having a capacity of 200 horsepower, the train being generally made up of a motor car and one or more trailers. The electrical outfit for the line has been supplied by the Oerlikon Company. Passing through a number of localities, such as Beringen and Lohningen, the present line has a total length of eleven miles. It receives current from the municipal electric plant of Schaffhausen, whose transformers supply three-phase current at 10,000 volts. The Siblingen substation, where the three-phase pole-line terminates, contains the rotary groups for supplying direct current for the trolley wire. There are installed in the plant two rotary groups of 200 horsepower each, driven by Oerlikon three-phase motors working upon 380 volts, the secondary potential of the station step-down transformers. Connected with the three-phase motor is a multipole generator of the electric-railway type, which supplies 800 volts, direct current, for the car motors. A storage battery consisting of 390 cells and having a capacity of 200 ampere-hours is mounted in parallel with the generator bars. The motor cars measure fifteen metres between buffers and are mounted on double trucks. Each of the trucks contains two fifty-horsepower motors, making four motors per car.

Among the most recent construction work in the Swiss region may be mentioned the new Bernina electric tramway. The starting point of the line is at Tirano and the route lies along the Poschiavo valley, passing thence by the lake of the same name and Bianco Lake, reaching the mountain region of the Bernina Pass, about which it winds for a considerable distance, offering a fine view of the glaciers of this region. The line then descends to its terminal point at Pontresina. Current for the present line is furnished from the Brusio hydraulic plant, which is fed by the waters of Poschiavo Lake. In the canton of Berne there is a project on foot for the erection of a large hydraulic plant, which is intended to work in parallel with the existing station of Hagneck. For this purpose a dam will be built upon the Doubs stream, near the locality of Souby, at a point where the river is twenty-five metres wide. From the dam there will be run a tunnel flume to the site of the turbine plant at Ocourt. In this way there will be furnished a head of water of forty metres, and the proposed plant will utilize 5,000 horsepower. Of greater size is a proposed plant which is to utilize the power of the Linth River. The rights for such a plant have been already asked from the cantonal government, and, according to the present project, it is to furnish 15,000 horsepower. A tunnel through the Bernardin is one of the most recent projects and will be used to make a railroad connection in this part of the Alps. The enterprise is an extensive one and the project is drawn up by the Buss firm of Switzerland. It is probable that the railroad which runs through the tunnel will be operated electrically.

Messrs. Bellini and Tosi are continuing their experiments in the way of wireless telegraphy by means of directed waves, using for this purpose the main station located at Dieppe and two similar posts at Havre and Barfleur, on the Channel coast of France. By their new method they are quite successful in directing the waves to Barfleur, for instance, without having the same waves affect the station of Havre, which lies nearly in the same line. In this connection I may mention that the work of installing the new wireless station at the Eiffel Tower is making good progress, and it will not be many months before messages will be sent from the plant. A. DE C.

GREAT BRITAIN.

(Special Correspondence.)

LONDON, NOVEMBER 27.—The confusion which had developed in the case of the London electricity supply question has been somewhat disentangled by the result of the proceedings before the Parliamentary Committee, which has now completed its labors, and a certain amount of order has been evolved out of this chaotic condition by the substitution of the London County Council as the one purchasing authority in the year 1831 instead of the different local authorities at different dates.

The interesting experiment now being carried out at Poplar by the local medical officer of health, who makes an electrolytic disinfectant for distribution among the inhabitants, has been reported upon by the bacteriologist to the Local Government Board. This report, which has been asked for in consequence of certain criticisms upon the system, is entirely in its favor, and states that one ounce of the electrolytic fluid to about one gallon of water will kill cholera and typhoid germs in two-and-one-half minutes.

Mr. W. M. Mordey, as the president of the Institution of Electrical Engineers, in a recent address dealt with the alleged backwardness of Great Britain in the electrical industry compared with the rest of the world, and gave figures to show that compared with Germany the consumption of electrical energy is greater here. The present industrial depression he attributed purely to home reasons, and mainly to the fact that users of electrical machinery purchase too much from abroad.

The Great Western Railway Company, which was the first to adopt a system of audible signaling on its locomotives, with a view to abolishing the semaphore system, is now to install this system upon a section of its main line. The system signals are in character essentially electrical and were described in these columns some months ago.

Efforts at running electric cabs and electric omnibuses are apparently destined to meet with more or less unsatisfactory results in London. The Electromobile Company, which promised at one time to establish a very lucrative business in the West End in hiring out electrically driven cars of various descriptions, has suffered a loss of about $7,500 on the past year's trading. The Electrobus Company is also meeting some difficulty in raising its new capital through the public, while a prospectus for placing electric taxicabs on the streets of London did not meet such response as to warrant the directors going to allotment.

An action is being taken in the British courts by the Johannesburg Corporation against the contractors for the famous gas-engine plant there for damages to the extent of $2,000,000, which sum, however, includes the balance of the cost of the plant, which is claimed back. The defense is that the failure of the plant to come up to specification was the unsatisfactory coal used in it. G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, DECEMBER 5.—The Brazilian Electro-Steel and Smelting Company of Toronto has been incorporated with a capital stock of $10,000,000. The provisional directors are those who usually appear in connection with the announcement of the incorporation of Mackenzie & Mann projects.

As regards the introduction of electric lighting by Canadian railways, both the Canadian Pacific and Grand Trunk railway companies are now carrying out duration trials on some of their cars. These cars have already covered a total mileage of over 1,000,000 miles without one report against them, and it is expected that similar installations will be gradually made until all the railway cars in the Dominion are thus equipped.

The sum of $1,500,000 from Chicago was deposited in a bank

at Hamilton, Ont., this week to be used by the Independent Telephone Company. This company is already established at Toronto with a charter covering rights to operate out of that city, and within two weeks construction work will be commenced between Montreal and Toronto. The company is already formed, and interested Chicago people are now in Toronto, one of the party being a member of the Chicago firm of Marshall Field & Company. With this project is associated Eugene M. Beals of New York, who has sole rights for the "Telepost" system of telegraphing. W.

WESTERN CANADA.

(Special Correspondence.)

WINNIPEG, DECEMBER 5.—The electric light and power commissioners of Edmonton, Alb., have discovered that more power is urgently needed by the city. The matter will be taken up by the City Council and arrangements made for the enlargement of the municipal plant. Commissioner McNaughton may be addressed in regard to this matter.

Several important by-laws will be voted on by the ratepayers at the coming municipal elections at Fort William, Ont. The sum of $18,000 is required for extensions and improvements to the municipal telephone system; $10,000 for the extensions to the electric lighting system; $5,000 for the installation of a fire-alarm system, and $170,000 for extensions, double-tracking, etc., of the street-railway system recently acquired from Port Arthur. Address Mayor Murphy, Fort William, Ont.

By a large majority the ratepayers of McLeod, Alb., have voted in favor of spending $55,000 for improvements and extensions to the municipal electric-lighting system. Address E. F. Brown.

Despite the fact Edmonton, Alb., has a new telephone system, there is already a shortage in the supply of instruments, the demand for connections having greatly exceeded the provision made for subscribers. The Council will at once arrange for the purchase of additional equipment. Address Superintendent Cummings.

At Calgary, Alb., a company being formed has applied for a charter to build an electric railway system from that city to Millarville, a distance of twenty-nine miles. So far the names of the incorporators have not been made known. E. L. Richardson, Calgary, can give particulars.

The stringing of the wires to the Silver King mine, near Nelson, B. C., by the West Kootenay Power Company, has been completed. The intention of the owners of this mine is to use electricity entirely in the future.

Superintendent McCauley of Port Arthur, Ont., who formerly had charge of the municipal street-railway system, has been appointed superintendent of the municipal electric-light, power and telephone systems in Port Arthur.

The Kootenay Telephone Company, with head office at Cranbrook, B. C., has announced its intention of building a long-distance line from Corbin to McGillvray, B. C., in connection with the development promised by the Corbin Coal Company of Spokane, Wash. The company is also arranging for the construction of a number of lines in Canada in that part of the country due north of Spokane as well as a long-distance line through the Crow's Nest Pass country to connect with the government system in the province of Alberta. R.

OBITUARY.

MR. FRANK MILLER, manager for the Southern Bell Telephone Company, died at Nashville, Tenn., November 29. His home was at Le Sourdsville, O. H.

MRS. MARY J. NATE, who died December 2, at the age of seventy-two years, was the mother of J. J. Nate, the well-known representative of the Stromberg-Carlson Telephone Manufacturing Company.

A. V. SCHROEDER, general manager of the Winona Railway and Light Company, Winona, Minn., died of typhoid fever at Winona the latter part of November. Mr. Schroeder was formerly electrical engineer for the Illinois Traction Company, and prior to that was electrical superintendent of the Springfield (Ill.) Light, Heat and Power Company. He was a prominent figure in the organization of the Minnesota Electrical Association.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

BRYAN, TEX.—The Bryan Telephone Company has increased its capital stock to $14,000.

YANKTON, S. D.—The Yankton Telephone Company will erect a new central office building. C.

ESSEX, IA.—The Farmers' Telephone Company has been organized with a capital stock of $15,000.

PARK, KAN.—The Park Telephone Company has been incorporated with a capital stock of $10,000.

BALSAM LAKE, WIS.—The McKinley Telephone Company has been incorporated. C. J. Porter is secretary.

BELFIELD, N. D.—Ed. O'Connor and others have incorporated an independent telephone company at Belfield.

UNIONTOWN, WASH.—The Uniontown Telephone Company has been incorporated with a capital stock of $5,000.

BARTLEY, NEB.—The Bartley Mutual Telephone Company has been incorporated with a capital stock of $12,000.

LEBANON, WIS.—The Lebanon Telephone Company has been incorporated with a capital stock of $10,000.

CHISHOLM, MINN.—The Mesaba Telephone Company is about to move its exchange office at Chisholm into larger quarters. A larger board will be installed. C.

WILLMAR, MINN.—The Tri-State Telephone and Telegraph Company has secured larger quarters at Willmar and will install day and night operation of the toll service. C.

MARSHALLTOWN, IOWA—The Farmers and Merchants' Telephone Company of Marshalltown, Iowa, has been incorporated with a capital stock of $250,000. The officers are: B. F. Cummings, president; E. H. Martin, vice-president; P. C. Holdoegel, secretary; J. P. Cooper, treasurer. C.

LADORA, IOWA—The Farmers' Mutual Telephone Company of Ladora, Iowa, was incorporated with the following officers: W. L. Morse, president; Fred Guehrn, vice-president; M. W. Kelting, secretary; H. C. Gates, treasurer; E. H. Matteson, J. W. Bean and Geo. W. Rumple, directors. C.

CULBERTSON, MONT.—The Dakota Western Telephone Company of Culbertson has been incorporated by H. C. McCartney and T. F. Marshall of Oaks, N. D., and J. J. De Laney of Streeter, N. D. The company is capitalized for $200,000. The line will extend from Palermo, N. D., to Havre, Mont. C.

LA PORTE, IND.—The South Bend Home Telephone Company is asking the La Porte City Council for a franchise to permit it to install ten toll stations in La Porte. This action is due to the fact, as alleged, that the La Porte Telephone Company has refused to make arrangements with the South Bend Home Telephone Company for an exchange of service. S.

RICHMOND, IND.—The working agreement between the Central Union and the Richmond Home telephone companies, by which the long-distance service of the former was provided to patrons, has been discontinued. This action was taken on the Ohio court's order enjoining the Central Union from alleged interference with independent companies in Ohio and Indiana. As a result the Central Union can no longer give long distance service to the patrons of the Home company unless they go to the Central Union Company's office. S.

MINNEAPOLIS, MINN.—The attorney-general of Minnesota has given notice to the effect that the Northwestern Telephone Company cannot continue to sell reduced-rate telephone coupons without violating the laws of Minnesota. The company asked the attorney-general if the selling of coupons good for ten to twenty-five dollars' worth of talk at a reduction of ten to twenty-five per cent from the usual rate were lawful. Following the decisions of the United States Supreme Court and Interstate Commerce decisions, G. W. Peterson, who wrote the opinion, says that the sale of the coupons at a discount favors the man with $10 to invest in long-distance talk all at once and discriminates against others.

PERSONAL MENTION.

MR. G. W. ARMSTRONG, Chicago manager of the Excello Arc Lamp Company, is making an extended trip through the South, and writes from New Orleans that he is finding business in fine condition. The southern people are in prosperous shape, crops are good, and "Excello lamps are seen everywhere."

MR. BERNARD E. SUNNY, president of the Chicago Telephone Company and vice-president of the American Telephone and Telegraph Company, has been elected president of the Cleveland Memorial Association, the object of which is to erect a suitable monument to the memory of the late Grover Cleveland.

MR. JOHN C. DOLPH has retired from the Standard Varnish Works, New York city, and will engage in the same line in an independent connection. Mr. Dolph has spent the last twelve years in a study of insulating varnish processes, and has been very successful in establishing and building up the insulator department of the Standard Varnish Works.

"HURRY-UP" YOST, Michigan University's famous football coach, has been selected general manager of the Great Falls River and Power Company, chartered to develop the power of Great Falls and to build an electric short line from Chattanooga to Nashville. The Michigan leader is to take the place of the late C. H. Fisk, who died in McMinnville recently.

MR. R. C. CAMPBELL, district manager for the Philadelphia office of the Adams-Bagnall Electric Company, of Cleveland, Ohio, has recently returned from an inspection tour abroad and has opened new offices in the Land Title Building, Philadelphia, where any communications or inquiries concerning tungsten incandescent lamps, open or enclosed arcs, for operation under all conditions and on all circuits, or any problems involving the field of illuminating engineering, will receive his prompt attention.

EDUCATIONAL.

POLYTECHNIC INSTITUTE OF BROOKLYN—The Polytechnic Institute of Brooklyn, according to the annual report of its president, Fred W. Atkinson, has a total enrollment of 179 students, of whom fifty-six are in the department of electrical engineering. Professor Samuel Sheldon reports on the marked improvement attained in the electrical course and adds that new exercises are being arranged which will require more extended work on the part of the students.

UNIVERSITY OF ILLINOIS INSPECTION TRIP—The University of Illinois departments of electrical and railway electrical engineering visited Chicago November 21 for an inspection trip through a number of electrical manufacturing and power-generating plants of the city. The electrical engineering students made an extended visit to Croton Dam, Mich., visiting the hydroelectric generating station of the Grand Rapids-Muskegon Power Company's 110,000-volt transmission line into Grand Rapids.

NEW PUBLICATIONS.

LIST OF ELECTRICAL FITTINGS—The October list of electrical fittings that have been examined and approved by the Underwriters' National Electric Association for use under the rules and requirements of the National Board of Fire Underwriters for the installation of electric wiring and apparatus has been issued. This list is revised semi-annually.

THE WESTINGHOUSE DIARY FOR 1909—The 1909 edition of the Westinghouse Diary is ready for distribution. This is the fifth edition of the diary, and although this reference book has been of great value to engineers in previous years, the present edition is an improvement over anything that has been published before. The information in connection with high-pressure steam turbines, condensers, low-pressure steam turbines, mechanical stokers, mercury-vapor lamps, meter testing, storage batteries, single-phase railway systems, tungsten lamps, turbo pumps and blowers, and Westinghouse Nernst lamps, is particularly complete and of great value.

PROPOSALS.

POST OFFICE BUILDINGS AT PARIS, ILL., AND JOHNSON CITY, TENN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 6 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Offices at Paris, Ill., and Johnson City, Tenn., in accordance with specifications which may be obtained from the custodians of the sites, or at the office of the Supervising Architect.

ELECTRICAL SECURITIES.

Last week's developments in the stock markets showed confused and erratic trading and irregular price movements. Artificial manipulation was in evidence, and this included activity in low-priced issues. The financial community, however, holds to the belief that the larger interests are still committed to higher prices. The approach of the end of the year and the usual January reinvestment demand should bolster up public confidence, and it is expected that these events will make for better market conditions. There has been no noteworthy change in the slow improvement in industry in general. Comparisons now being made with last year's period of depression may be misleading, and for some time it is evident that reports of gross earnings should be analyzed very carefully.

Dividends have been declared upon the following electrical securities: Twin City Rapid Transit Company; regular quarterly dividend of one-and-three-fourths per cent on the preferred stock, payable January 2 to stock of record December 15. Butte Electric and Power Company; regular quarterly dividend of one-and-one-half per cent on the common stock, payable January 2 to stock of record December 20. Interborough Rapid Transit Company; regular quarterly dividend of two-and-one-fourth per cent on the capital stock of the company, payable January 2 to stock of record December 19. Chicago City Railway Company; regular quarterly dividend of one-and-one-half per cent, payable December 30 to stock of record December 8. United Traction and Electric Company; regular quarterly dividend of one-and-one-fourth per cent, payable January 2. Seattle Electric Company; a dividend of $2.75 a share on the common stock, payable January 15 to stock of record at the close of business January 1. Indianapolis Street Railway Company; a dividend of three per cent, payable January 1 to stock of record December 23. St. Joseph Railway, Light and Power Company; a quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable January 1 to stock of record December 15. United Traction and Electric Company of New Jersey; quarterly dividend of one-and-one-fourth per cent, payable January 2. Wilkesbarre Gas and Electric Company; quarterly dividend of one per cent, payable January 2 to stock of record December 17.

ELECTRICAL SECURITIES FOR THE WEEK ENDED DECEMBER 5.

New York:	*Closing.*
Allis-Chalmers common	15⅛
Allis-Chalmers preferred	48⅞
Brooklyn Rapid Transit	55½
American Telephone and Telegraph Company	123¾
General Electric	157
Interborough-Metropolitan common	14½
Interborough-Metropolitan preferred	35½
Kings County Electric	127
Mackay Companies (Postal Telegraph and Cable) common	75
Mackay Companies (Postal Telegraph and Cable) preferred	70
Manhattan Elevated	149
Metropolitan Street Railway	25
New York and New Jersey Telephone	114
Western Union	69½
Westinghouse Manufacturing Company	89½
Boston:	*Closing.*
Edison Electric Illuminating	250
Massachusetts Electric	58½
New England Telephone	124½
Western Telephone and Telegraph pref.	75
Philadelphia:	*Closing.*
Electric Company of America	10¼
Electric Storage Battery common	42½
Electric Storage Battery preferred	42½
Philadelphia Electric	11¼
Philadelphia Rapid Transit	22
United Gas Improvement	92½
Chicago:	*Closing.*
Chicago Telephone	129
Commonwealth Edison	106⅝
Metropolitan Elevated preferred	48
National Carbon common	85
National Carbon preferred	112

ELECTRIC LIGHTING.

(Special Correspondence.)

PRESCOTT, WIS.—The Prescott Light and Power Company has been incorporated with a capital stock of $30,000.

HARRISON, N. J.—The Strang Electric Company has been incorporated in New Jersey with a capital stock of $25,000.

STEVENSVILLE, MONT.—G. W. Messer and Mr. Featherstone have applied for an electric-lighting franchise for Stevensville. C.

MURRAY, IOWA—A vote will be taken on December 15 at Murray on the question of granting a franchise to Mr. Murray for an electric-light plant. C.

GRIDLEY, CAL.—The City Clerk of Gridley is advertising for bids for furnishing and constructing an electric-lighting plant and distributing system for the city. A.

POSEYVILLE, IND.—The directors of the Poseyville Light and Power Company have decided to extend its transmission line to Cynthiana, a distance of fourteen miles. S.

SLATEDALE, PA.—The Slatedale Electric Light, Heat and Power Company is to be incorporated with a capital stock of $10,000. Wilson Rex is president of the company.

OLNEY, ILL.—The power plant of the Olney Electric Light and Power Company was completely destroyed by fire with a loss of $30,000, of which $17,000 was covered by insurance.

EVANSVILLE, IND.—Plans have been ordered by the Evansville Gas and Electric Light Company for the improvement and enlargement of its plant and the installation of some new equipment. S.

TWIN BRIDGES, MONT.—It is reported that Twin Bridges will be supplied with electric light from the power line which the Madison River Power Company will build from Renova to Sheridan. C.

SPRINGFIELD, ILL.—The Consumers' Electric Company, of Springfield, has been incorporated, with a capital stock of $1,000, to furnish light, heat and power. James A. Hull heads the company.

SANTA BARBARA, CAL.—The Water Commissioners of Santa Barbara have awarded to the Reynolds Electrical Company a contract for cable work and the installation of transformers amounting to $2,550. A.

NORCROSS, GA.—Norcross has voted for bonds, thirty to one, for electric lights. The Mayor and Council ordered the election for the purpose of voting upon the question of issuing bonds to the amount of $5,000.

WILMINGTON, DEL.—The Columbia Power, Light and Railways Company has been incorporated with a capital of $1,200,000 by W. H. Sprousler, Bloomfield, Pa.; M. P. Reed, Philadelphia, and C. L. Ward, Wilmington.

TIPTON, IND.—The Indiana Gas and Electric Light Company has applied for a franchise for a central plant, to be located at Tipton, agreeing to furnish both gas and electricity at a greatly reduced rate from that now charged. S.

RACINE, WIS.—Joseph Horlick, Jr., has undertaken the development of waterpower at the Rapids Dam, near Racine. He is under contract to furnish electricity for nearby plants and towns, and work is to be commenced immediately.

BOSTON, MASS.—The Gas Commission has approved of an issue of $15,000 additional stock by the Marion Gas Company, to be offered to stockholders at $100 per share, the proceeds to be used in the construction of an electric light and power plant.

CALISTOGA, CAL.—The plant, franchise and other property of the Calistoga Electric Light and Power Company at Calistoga has been sold under execution by the sheriff for the extremely small amount of $2,000. The buyer was William Spiers of Lakeport, Cal. A.

SABINAL, TEX.—The electric light and power company is now at work erecting poles and wires on the streets, and it is expected that the plant will be in operation within a few days. The company has been granted a franchise by the town for twenty years.

SAN JOSE, CAL.—R. W. Hersey of San Jose, promoter of the National Park Electric Company, and a party of engineers are now in Tuolumne County inspecting the site of the proposed plant. Mr. Hersey announces that work on the plant will be begun next spring. A.

LINTON, IND.—The City Council at its last meeting took steps to improve and increase the capacity of the electric-light plant. Those opposed to municipal ownership insist upon the sale of the plant, but the Council has decided otherwise and will improve the plant. S.

SAN FRANCISCO, CAL.—It is given out that a new electric power company to be known as the United States Electric Light and Power Company and to have an authorized capital stock of $40,000,000 will file articles of incorporation in San Francisco within a few days. A.

ESCANABA, MICH.—The Escanaba Power Company has been launched by O. L. Huie, formerly manager of the local traction company at Marinette, Wis., to construct a second power dam, capable of developing 2,500 horsepower, across the Escanaba River at Gross, Mich.

EUGENE, ORE.—The City Council of Eugene has decided on the construction of a power plant on the McKenzie River, about fifteen miles from the city. The power developed will be used chiefly for the operation of pumps for the recently-acquired water plant of the municipality. A.

ALBANY, N. Y.—The Central Station Operating Company, with a capital of $25,000, has been incorporated, to furnish gas and electric light in all the cities and villages in the state. The directors are William H. Sheehan, Edward F. McAviney and Frank L. Smith, of New York city.

ANDERSON, IND.—The Sefton Manufacturing Company of Anderson has decided to enlarge its local plant which, when completed, will cover nearly seven acres. The plant will be equipped with electric power throughout. Ex-Governor W. T. Durbin is vice-president and manager. S.

LOS ANGELES, CAL.—The San Joaquin Light and Power Company of Los Angeles, which has a plant under way on the Middle Tule River in Tulare County, is reported to have secured the site for its proposed dam on the Tule River by the purchase of the entire property on which the site was located. A.

AGNEWS, CAL.—The Board of Managers of the Agnews State Hospital at Agnews, Cal., is advertising for bids for the furnishing and erection of a power plant and conduit system to include boilers, engine, generators, switchboard, conduit pipe, wire and wiring. Bids will be received until December 16. A.

CAMAS, WASH.—Two applications for franchises for electric lighting have been presented to the Camas City Council. A steam plant is proposed by Kelley Loe, who applied for a fifty-year franchise, while G. S. Smith of Washougal contemplates building a system to supply both towns with power from the Washougal River.

CHICAGO, ILL.—It has been definitely announced that the Commonwealth Edison Company has acquired the property and franchises of the Cosmopolitan Electric Company. The latter was recently granted a building permit for a power house costing $280,000, to replace its present plant at Canal and Grove streets and the south branch of the Chicago River.

PORTLAND, ORE.—F. S. Morris, of Morris Bros., Portland, has begun preliminary work for the construction of a power plant on the Clackamas River, near Portland. It is given out that the plant will have a capacity of 15,000 horsepower and will cost in the neighborhood of $500,000. The work includes the building of a dam 400 feet long and forty feet high. A.

SEATTLE, WASH.—The Pacific Coast Light and Power Company of Seattle, Wash., has begun condemnation proceedings for the purpose of securing water rights on White River which are supposed to be the property of the Muckleshoot Indians. The company plans to convey water from White River to a point on Stuck River, where the power house will be located. A.

TACOMA, WASH.—The City Council of Tacoma has called an election for December 16 to vote on the question of the construction of a municipal electric power and lighting plant of 20,000 horsepower on the Upper Nisqually River at a cost of about $2,000,000. On the same date the issue of bonds to the amount of $300,000 for the preliminary expenses for rights, etc., will be voted on. A.

EASTON, PA.—The Easton Gas and Electric Company has a project on foot that is bound to result in benefit to the city and community. By the erection of a sign the name and location of Easton is to be burned into the minds of travelers on the various railroads passing through the city. The people of the city are asked to do their share, and a slogan is to be selected and suggested by the people.

BELLINGHAM, WASH.—Howard E. Grant, manager at Bellingham, Wash., for Stone & Webster of Boston, announces that it has been decided to double the capacity of the power plant on the Nooksaak River, controlled by Stone & Webster, the cost of the improvement to be about $250,000. When the changes are completed the power plant will be made the distributing point for the company's interurban railway lines. A.

PORTLAND, ORE.—President Josselyn, of the Portland Railway, Light and Power Company, has approved of the order for underground conduits for the company's system in the business section of the city. Work will commence at once. When completed it will cost in the neighborhood of $1,250,000. Orders have also been given for the installation of new machinery at the Alder and Seventh streets substation at a cost of $150,000. A.

JOLIET, ILL.—The Illinois Steel Company has entered into a contract with the Sanitary District of Chicago to use 1,200 horsepower of electrical energy from the latter's hydroelectric plant at Lockport, Ill. A special transmission line about three miles long will be built from this plant to the steel works. This will be fed directly from the generator buses at 6,600 volts and will be distinct from the 45,000-volt transmission line to Chicago.

LA CROSSE, WIS.—Governor Johnson of Minnesota and Governor Davidson of Wisconsin have been invited to attend the ceremonies marking the formal opening of the works of the La Crosse Water Power Company about December 15. The dam is 50 feet high, 50 feet wide at the base and 495 feet long, damming the Black River into a reservoir lake in its rear. This lake is five-and-one-half miles long and in some places two-and-one-half miles wide. When the water is over the dam there is a storage reserve of 479,160,000 cubic feet.

LEXINGTON, N. C.—The Fries Power Company has closed a contract with the Southern Power Company, the great water-power concern below Charlotte, on the Catawba, whereby this company will enter Winston and furnish 1,500 horsepower of electricity. The transmission lines will be built through Lexington, High Point and Greensboro, these towns, including Thomasville, having the opportunity of securing electric power, also. The Southern Power Company has already built lines and is furnishing power to Charlotte, Mooresville, Statesville, Newton and various other communities.

MERRILL, WIS.—Current has been turned on from the recently completed hydroelectric power plant at Grandfather Falls. The dam is 700 feet long and 70 feet in height. At the right end is the power house, which is 44 feet square and 23 feet high. In this is installed one 1,400-kilowatt generator with its exciter. Other flumes have been constructed to receive additional units to the amount of 3,700 kilowatts when necessary. The power is transmitted twelve miles to the city over high-tension transmission wires, and is used at the mills of the Grandfather Falls, and for lighting purposes at Grandfather.

NORTH YAKIMA, WASH.—Another big electric-power project, where 4,000 to 5,000 horsepower can be developed from the Naches River flow, is planned for the vicinity of North Yakima. Local capitalists have already procured a site for a new power house and the right-of-way for the canal to it, assuring a drop of sixty feet to the power wheel. The power estimated is at the lowest stage of the river. There are now four big power projects under construction near North Yakima, that of the Northwest Light and Power Company, the Yakima Valley Transportation Company's canal through the Moxee to Union Gap, and the East Selah project in the Yakima River Canyon, besides the new one.

OAKLAND, CAL.—The Great Western Power Company of San Francisco has completed the installation of the first unit of its power plant on the Feather River as well as the cementing of the three-and-one-half-mile tunnel which will convey water to the power house. December 10 was set as the date for starting the plant. The initial production will be 20,000 horsepower of electric energy. It is expected that the company's transmission line to Oakland on San Francisco Bay will be completed about that time. The company has filed deeds for a right-of-way through the lands of the People's Water Company in Alameda County, Cal., and will erect its line over the property at once. A.

COLORADO SPRINGS, COLO.—The controlling interest in the Empire Water and Power Company was recently sold to George Bullock, of New York, president of the Colorado Springs Electric Company. Mr. Bullock announced that development to the extent of $500,000 will be prosecuted within the next twelve months. The company owns valuable water rights on the north slope of Pike's Peak and has plans already made for the building of three large reservoirs with necessary pipe lines and an electric power plant in Manitou that will develop 3,000 horsepower, which will be used in supplying power to the large mills and other manufacturing concerns in the Pike's Peak region.

SALT LAKE CITY, UTAH—The application for water power for the largest electric producing plant in Utah has been filed with the state engineer by the Grand Canyon Power Company, Incorporated. The company asks for 2,000 feet of water per second from the Green River, which will be used in running a plant capable of producing 38,000 horsepower. The fees paid for the water rights are $2,000. The plan of the company is to place an immense dam in the Green River 200 feet below its junction with the Coal Creek in Emery County. This will back the water up in Green River for twenty miles. Near the junction of Coal Creek with Green River a diverting channel will be constructed. It will be twenty-four feet wide, ten feet deep and 9,000 feet long.

BELLOWS FALLS, VT.—The Cavendish Gorge hydroelectric generating plant of the Claremont Electric Company is now practically in commission and supplying electricity for a variety of purposes. The dam is of concrete, fifty-four feet high and 107 feet wide along the crest or rollway. The thickness below the water line is thirty-eight feet. There are two gates and a forty-eight-inch waste-water pipe. The gate leading into the forebay is nineteen feet below water surface. From the forebay an eight-foot tunnel extends through 200 feet of rock, connecting with a steel penstock six feet in diameter and 1,100 feet long, that conveys the water to the turbines in the power house. In the brick and concrete power house are three Pelton wheels, direct-connected to an equal number of Fort Wayne generators of 500 kilowatts capacity.

SAN FRANCISCO, CAL.—Several large appropriations of water for electric power purposes in California have been made during the last few days. Most of these are in the northern part of California. Among these are: The appropriation of 300,000 inches from the Sacramento River at Tron Canyon by Paul Stoll; the appropriation of 8,000 inches from Deer Creek, near Chico, by William Elliott; 11,000 inches from Battle Creek by H. A. Tedford and W. W. Wheeler. In central California, J. W. McLaughlin and C. K. Kirby have appropriated 300,000 inches of water from the San Joaquin River to be diverted in Fresno County. The Mountain Development Company of Tacoma, Wash., has appropriated 2,000 cubic feet of water from the south bank of White River, near Tacoma, to be stored and used for electric power purposes. The latter company has just been incorporated with a capital stock of $200,000 by B. P. Simonds, Robert M. Davis and A. J. Firmin. A.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MISSOULA, MONT.—W. A. Clark and others have been granted a fifty-year franchise for an electric line. P.

GRAND FORKS, N. D.—The Grand Forks Street Railway Company is to be incorporated with a capital of $150,000. P.

GRUNDY CENTER, IOWA—A right-of-way has been granted at Grundy Center to the proposed electric road from Waterloo to Perry. C.

SIOUX CITY, IOWA—The Sioux City and Spirit Lake Interurban has petitioned for franchises in Spirit Lake, Hartley and Le Mars, Iowa. C.

BUXTON, IOWA—An interurban railway is projected by Byllesby & Company of Chicago, from Ottumwa to Buxton, passing through Eddyville. C.

JACKSON, MINN.—It is proposed to build an electric line from Jackson to Spirit Lake, Iowa, to connect the Sioux City and Spirit Lake road with the Dan Patch Air Line. C.

ELGIN, ILL.—The De Kalb Midland Railway Company has been formed to construct and operate an electric railway from De Kalb to Sandwich, Ill. The capital stock is $150,000 and the incorporators are John W. McQueen, Herbert J. Burdick and John F. Pearce.

L'ANSE, MICH.—The new hydroelectric power plant at L'Anse has been started successfully. This generating station is one of the few waterpower plants in the northern peninsula of Michigan and was constructed after a new steam plant had already been built and discarded.

BERNE, IND.—The stockholders of the Bluffton, Berne & Celina Company, recently organized to construct a traction line between the cities above named, will file articles of incorporation during the coming week. Bids will be received in a short time for the construction of the road. S.

SAN FRANCISCO, CAL.—The delay in the return of President Patrick Calhoun of the United Railroads of San Francisco to California has led to a number of rumors of a possible sale of the company to E. H. Harriman or to interests allied with Mr. Harriman. All knowledge of such a move is denied by the company's representatives here. A.

GARY, IND.—The construction of a street railway connecting the cities of Whiting, Indiana Harbor and Gary is the object of the franchise now being asked of the City Council of East Chicago. The capitalist behind the project is Louis N. Erb, of Chicago, who with other Chicago capitalists recently procured a franchise to enter the city of Whiting. S.

CHICAGO, ILL.—Receivers J. B. Forgan and John M. Roach of the Consolidated Traction Company were given leave of court on December 2 to borrow $200,000 for use in rehabilitation work on the Cicero & Proviso branch of the Consolidated lines. The receivers were authorized to pledge the receipts of the road until 1910 as security for the money to be borrowed.

INDIANAPOLIS, IND.—J. W. Wood of Evansville, senior member of the Indiana Railroad Commission, who has been elected chairman of the Commission, just returned from a meeting of railroad commissioners held in Chicago and reports that the commissioners from Illinois, Michigan and Minnesota decided to adopt the Indiana plan of separating grade crossings of railroads. S.

SOUTH BEND, IND.—The Chicago, Lake Shore & South Bend, the traction line between South Bend and Chicago, which is now in operation between South Bend and South Chicago, has been officially changed in name to the South Shore Line. The company has ten cars in operation between South Bend and Hammond, eleven to Michigan City and twenty-nine to Hammond and Gary. S.

SOUTH BEND, IND.—Under the authority of the board of public works, the South Bend police stopped the Chicago, South Bend & Northern Indiana Traction Company from stretching an overhead feed-wire in the business district of the city. The wire was being stretched on the trolley poles in violation of an ordinance providing that all wires in the business district must be placed underground. The board has also instructed the city attorney to bring proceedings against any person or corporation violating any provision of the ordinance governing wires in the underground district. S.

DETROIT, MICH.—The franchise of the new Windsor Tunnel & Lake Erie Electric Railway Company is now before the City Council of Detroit. The company has agreed to issue workingmen's tickets at eight for a quarter during four hours of the day, with five-cent fares at all other times. The promoters of the road will apply immediately to the Government for a charter of incorporation.

GOSHEN, IND.—Harry L. Weber, consulting engineer in the employ of the Ohio & Indiana Traction Company, and an expert in interurban railway engineering, with a company of assistants, arrived to survey a line between Goshen and Kendallville. Mr. Weber comes in the interest of Boston capitalists, who are proposing to construct the line which is supposed to be the beginning of an interurban line from Chicago to New York. S.

INDIANAPOLIS, IND.—A contract for the construction of a $4,700,000 interurban traction line to connect the cities of Des Moines and Sioux City, Iowa, has been awarded to the American Engineering Company of Indianapolis. The line will be about 196 miles long and will be a part of the triangular system that is being constructed to connect Des Moines, Sioux City, Omaha and Council Bluffs. Chas. N. Wilson, president of the construction company, says that the line will ultimately be a connecting link between Ohio, Indiana and the West. S.

TERRE HAUTE, IND.—The United States Express Company has opened offices in Terre Haute to operate over the four branches of the Terre Haute, Indianapolis & Eastern Traction Company, to Paris, Ill., Sullivan, Clinton and Indianapolis and eastward. The traction company has been doing a semi-express business in connection with its freight business, but did not collect or deliver packages as will now be done by the United States company. It is understood that the deal covers all the lines of what is known as the McGowan syndicate. S.

SAN FRANCISCO, CAL.—Charles N. Black, vice-president and general manager of the United Railroads of San Francisco, announces that eight carloads of power machinery are now due in the city. This will be installed at once and will go far to repair the company's system and put it in shape to resume a full service on its lines. A recent accident to a 6,000-horsepower frequency-changer did considerable damage to the system, rendering it unable to handle some of the power which it had been taking from the City Electric Company. Some of the machinery rented from the Pacific Gas and Improvement Company has also been out of order, but it is expected that this will soon be remedied. A.

SAN FRANCISCO, CAL.—Vice-President and General Manager E. E. Calvin, of the Southern Pacific Company, denies specifically the report that the company has secured control of the Great Western Power Company or of any other power company. He says: "The Southern Pacific Company has bought no power company and owns no sites of its own in the Sierras. We are not planning to operate our suburban trains by hydroelectric plants, but are going ahead with our steam power plant in Oakland. We have cheap oil of our own for use in developing power and do not anticipate that any of the power companies with hydroelectric plants will be able to supply us with power cheaper than we will be able to generate it in our Oakland plant. If any company offers to do so we shall accept the offer and hold our Oakland plant as a reserve plant. A considerable part of the machinery for our Oakland plant is already on the way and more is being manufactured. The trolley wire and feed wire is already on hand. The suburban railway lines in Alameda, Berkeley and Oakland will be converted into trolley lines at once in the order named. The line south from San Francisco will be a third-rail line. The matter of using electricity for the operation of our transcontinental lines over the Sierra Nevada Mountains is for the distant future." A.

INDUSTRIAL ITEMS.

THE SOUTHERN ELECTRICAL AND INDUSTRIAL EXPOSITION has been incorporated at Louisville, Ky. The officers are: F. W. Keisker, president; J. V. Beckmann and F. C. Nunemacher, vice-presidents, and A. T. Macdonald, secretary.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, 184 Lake Street, Chicago, Ill., has ready for distribution some interesting information in booklet and pamphlet form concerning Christmas-tree outfits. This literature will be sent to those interested upon request.

THE BRILL CAR WORKS, Philadelphia, Pa., suffered damage by conflagration on Sunday, November 29, variously estimated from $100,000 to $250,000, pending the company's official estimate of the loss. It is believed that the damage will not interfere seriously with any of the company's contracts.

THE CHICAGO MICA COMPANY, Valparaiso, Ind., announces that Judge Anderson, in the United States Circuit Court, District of Indiana, on December 4, at Indianapolis, refused the plea of the Mica Insulator Company for a temporary injunction to enjoin the Chicago Mica Company from manufacturing mica insulating plates.

THE STEEL ROLL MACHINE COMPANY, 254 East Madison Street, Chicago, manufacturer of laundry equipment, calls attention to the waste involved in throwing away soiled printers' cleaning rags, which, it advises, should be washed in a power washing machine of its manufacture. The rags are washed and rinsed thoroughly without attention.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., devotes the November issue of its monthly house organ *Paistery* to describing and illustrating its National Electrical Code standard pipe taplets adapted for a variety of uses. The pipe taplet is attached to the conduit by pipe threads, located inside the sleeve. A set-screw method of adjustment enables the work to be lined up perfectly.

THE WESTERN ELECTRIC COMPANY, Chicago, in a little booklet entitled "Pointers on Power" describes in an attractive way a number of the applications of its line of alternating-current induction motors. The variety of uses illustrated includes the employment of these motors in driving centrifugal pumps, sheet-metal machinery, turn-table tractors, conveyers, dough mixers, wood-working machinery and exhaust fans.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., in bulletin No. 4627, describes its curve-drawing instruments for alternating and direct-current circuits. These instruments, though in commercial use for several years, have been recently improved by the General Electric Company, and the illustrations and descriptions contained in the bulletin are of interest. The bulletin contains, also, connections, dimensions and other data.

THE GREGORY ELECTRIC COMPANY, Chicago, dealer in electrical apparatus and machinery, has issued a new bargain sheet showing its complete stock. The company is offering exceptional bargains in alternating-current motors, which will doubtless prove attractive to a great many possible buyers. The company is well equipped for the buying and selling of second-hand machinery and is one of the largest dealers in this line. It will be glad to send its latest bargain sheet to interested parties.

THE ELECTRIC MOTOR AND EQUIPMENT COMPANY, Newark, N. J., announces that it has succeeded to the business of the American Chemical Company, formerly conducted by H. C. Swann at 79 Cortlandt Street, New York city. The latter company manufactured the well-known "Faultless" lamp coloring and "Faultless" weatherproof lamp coloring. These colorings, which have been in the market for eight years, are furnished in eighteen colors and shades, or any desired blend to order.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a new line of circulars especially devoted to articles intended for holiday gifts, such as electric-heating devices, Christmas-tree outfits, electric curling-irons, etc. A new folder describes the "Never Break" electric lamp guards and approved electrical fittings. This circular consists of forty pages of descriptive matter, supplemented by interesting information taken from the reports of the Electrical Bureau and National Board of Fire Underwriters. Copies will be sent upon request.

THE GAS CANNON COMPANY, South Bethlehem, Pa., is distributing an interesting circular calling attention to the flintlock model of the gas cannon. This cannon works on the principle of the ordinary gas engine. Gas is allowed to flow into the gun and mix with the air. The mixture is ignited, producing an absolutely harmless explosion. The cork or wooden projectile is not dangerous, and a heavy metal projectile cannot be thrown by the gun at all. There is no other element of danger, because the tongue of flame from the gun will not set fire even to tissue paper or burn the skin.

THE HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, N. H., announces that it has opened an office at 161 Summer Street, Boston, Mass., to take care of its New England trade. The demand for Hoyt instruments from New England centers has shown such a steady and consistent increase since they were first offered a year ago that it was felt the interests of the company's patrons could best be served in this way. The office will be in charge of H. F. Kellogg, a pioneer in the electrical field, and well known in automobile circles. A complete stock of instruments will be carried at all times.

THE CARLYLE-JOHNSON MACHINE COMPANY, Hartford, Conn., has a new catalogue descriptive of the Johnson friction clutch. This clutch has but few parts and is very compact. A body fastened to the shaft carries a split ring in which are inserted a pair of levers. A curve-shaped wedge, which is made part of a shipper sleeve, forces the levers apart, expanding the ring, bringing its outer surface into frictional contact with the inner surface of the friction cup, the hub of which is made to suit requirements. The leverage is so compounded that it requires but little pressure to operate the clutch.

THE HARVARD ELECTRIC COMPANY, 66 West Van Buren Street, Chicago, and 136 Liberty Street, New York, manufacturer of steel brackets, conduit boxes, sectional switch boxes, fuse wire, electrical specialties, etc., announces that since recovering from the August fire which nearly destroyed the Harvard plant, the factory has been working overtime, the total of the October orders being greater than those of any two months during the 1908 season. Allen L. Haase, sales manager of the company, recently returned from a trip through the South and reports exceptionally bright prospects in all the cities he visited.

THE MINNEAPOLIS ELECTRIC AND CONSTRUCTION COMPANY of Minneapolis, Minn., which, for a number of years, has placed on the market a wire-measuring machine which reels wire into a coil and shows the number of feet, is meeting with excellent success. This reel, the manufacturer states, is now used in almost every state in the Union. The company recently received an order from the United States Government for an electric wire meter to be used for measuring signal wire in the Navy Yard, Seattle, Wash. The same device is also used by the United States Government in Manila. The Otis Elevator Company, Minneapolis, made a test on one of the company's large size meters, measuring seven-eighths-inch steel cable, which proved very satisfactory.

C. H. CHALMERS, vice-president of the Electric Machinery Company, Minneapolis, reports a satisfactory business and states that the outlook for the coming year is encouraging. The company has recently booked a number of new orders, among them being one from the Acme Cement Plaster Company, Acme, Texas, secured through the Wesco Supply Company of St. Louis, for one 180-kilowatt revolving-field alternator. The Electric Machinery Company is also installing two 300-kilowatt machines for the Peerless Electric Company, Warren, O., making four machines in all. Two seventy-five-kilowatt engine-type generators, one thirty-kilowatt motor-driven and one twenty-kilowatt balancing sets are being shipped to the Southern Pacific Railway at San Francisco. This order was secured through the company's Pacific agents, the Standard Electrical Works.

THE PETTINGELL-ANDREWS COMPANY, Boston, for December presents the first issue of its new house organ, entitled "Juice." Between striking covers are well-printed pages describing and illustrating "O. K." connection blocks, "Opalux" reflectors, "P-M" remote-control switches, "New Wrinkle" sockets, and other specialties. The leading article, relative to devices designed to prevent the theft of current from unauthorized taps outside the meter, is accompanied by thirty views and diagrams of connection blocks, showing the variety of connections that can be made with these blocks for purposes of applying test instruments, without interrupting the continuity of the consumer's service. "Juice" wil be regularly mailed to central stations, street railways, electrical engineers, architects, contractors, dealers and isolated manufacturing plants using electricity.

THE WHEELER CONDENSER AND ENGINEERING COMPANY, Carteret, N. J., has just published "The Wheeler-Edwards Air Pump," an elaborate thirty-two-page treatise which explains the peculiar action of the Wheeler-Edwards pump in handling both air and water. It is shown how the absence of foot and bucket valves, and an exceedingly small clearance, results in the attainment of a high vacuum, otherwise to be had only by means of separate dry vacuum pumps, hot well pumps and air coolers. Various types of Wheeler-Edwards pumps are shown, as well as a number of large steam-turbine installations in which these pumps are used. The latter half of the book is made up of the discussions of the principles of air pumps, tables of mixed vapors, a complete and original table of saturated water vapor from 60 to 180 degrees F., etc. The final section gives practical instructions for the handling of pumps of this character. This booklet should be valuable to anyone interested in vacuum machinery.

NEW MANUFACTURING COMPANIES.

DULUTH, MINN.—The Duluth Electrical Company of Duluth, with a capital stock of $25,000, has been incorporated by J. W. Day, M. J. Day and H. J. Rich. C.

BROOKLYN, N. Y.—The Bell Arc Light Company, of Brooklyn, has been organized with a capital of $100,000. The directors are: Charles A. Campbell, Henry W. Van Allen and Monroe May, all of New York.

SCHENECTADY, N. Y.—The Tirrill Manufacturing Company has been incorporated with a capital stock of $100,000, to manufacture electrical appliances and machinery. The members of the company are Allen A. Tirrill, Everett E. Lucas, Franklin W. McClellan, Schenectady.

NEW YORK, N. Y.—The Jaeger Tungsten Company of Manhattan has been incorporated to manufacture Tungsten lamps, electrical and illuminating appliances, etc., with a capital of $30,000. The incorporators are W. C. Liliehold, Brooklyn; C. S. Pinkney, H. J. Robinson and J. Wilzing, New York city.

ENGINEERING SOCIETIES.

ARMOUR INSTITUTE BRANCH, A. I. E. E.—At the meeting of the Armour Institute Branch, American Institute of Electrical Engineers, held in Chapin Hall on December 3, an interesting paper on "Alternating-Current Single-Phase Commutator Motors" was presented by Tracy W. Simpson. All the commercial forms of these motors were analyzed and their characteristics pointed out. On January 7, 1909, Arthur P. Strong will present a paper on "Economic Considerations in the Design of Multi-Office Trunk Telephone Systems;" this paper was originally announced for December 17, but was postponed to the first meeting in 1909 on account of conflict with Dr. Steinmetz's lecture to be given on that date.

Directory of Electrical and Allied Engineering and Scientific Societies.

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AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, Walker Electric Company, Twenty-third and Noble streets, Philadelphia, Pa. Next meeting, January, 1909.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Cosmos Club, Washington, D. C. Annual meeting, Baltimore, Md., December 28-January 2.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis Avenue, New York, N. Y.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN INSTITUTE OF MINING ENGINEERS. Secretary, Rossiter W. Raymond, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th Street, New York, N. Y.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN-RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa. Annual meeting, New York, N. Y., December 28-30.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Forty-seventh Street, New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, A. P. Folwell, 239 West Thirty-ninth Street, New York, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth Street, New York, N. Y.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, secretary and treasurer Tri-City Railway Company, Davenport, Iowa.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass.

AMERICAN STREET AND INTERURBAN RAILWAY TRANSPORTATION AND TRAFFIC ASSOCIATION.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, superintendent of lighting Hot Springs Light and Railway Company, Hot Springs, Ark.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF CAR-LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Chicago, Ill.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, D. L. Huntington, second vice-president and manager Washington Water Power Company, Spokane, Wash.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, Welles E. Holmes, 308 Washington Street, Newton, Mass.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick Streets, San Francisco, Cal.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda Street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Traction Terminal Building, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Colo.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Conn.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, George William Russell, Jr., 500 Fifth Avenue, New York, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine Street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago, Ill.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Stanley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, Cal., first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall Street, New York, N. Y. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau Street, New York, N. Y.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary H. G. Perring, 1317 Spruce Street, Philadelphia, Pa.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt Street, New York, N. Y.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Van Rensselaer Lansingh, Engineering Societies Building, 33 West Thirty-ninth Street, New York, N. Y.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Allen J. Paylow, Rockport, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ward, Grand Rapids, Mich. Secretary's office, Monadnock Building, Chicago, Ill.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress Street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby Street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MILWAUKEE SOCIETY OF ENGINEERS. Secretary, W. Fay Martin, 456 Broadway, Milwaukee, Wis.

MISSOURI ELECTRIC LIGHT, GAS AND STREET RAILWAY ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schweer, Windsor, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, Commonwealth Edison Company, Chicago, Ill.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln, Neb.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State Street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl Street, Boston, Mass. Meetings held on fourth Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth Street, New York, N. Y.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Temporary secretary, J. D. Crary, Aberdeen, Wash.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, R. M. Kimball, Kenosha, Wis. Annual meeting, Milwaukee, Wis., January, 1909.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Ballard, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, Frank J. Scherrer, New York, N. Y.

ORDER OF THE REJUVENATED SONS OF JOVE. Mercury, C. B. Roulet, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. S. Smith, Towanda, Pa.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second Street, Philadelphia, Pa.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Next annual meeting, Louisville, Ky., October 12-14, 1909.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, J. A. Myler, Jr., 608 Juanita Building, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Co., New York, N. Y.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, G. M. Goddard, 55 Kilby Street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 382 Ohio Street, Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

ALABAMA LIGHTING AND TRACTION ASSOCIATION. Temporary secretary, F. K. Jackson, Mobile, Ala.

DATES AHEAD.

American Roentgen-Ray Society. Annual meeting, New York city, December 28-30.

Chicago Electrical Show. Coliseum, Chicago, Ill., January 16-30, 1909.

American Association for the Advancement of Science. Annual meeting, Baltimore, Md., January, 1909.

Northwestern Electrical Association. Annual meeting, Milwaukee, Wis., January, 1909.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) December 1, 1908.

905,130. MACHINE FOR CRIMPING ELECTRIC RESISTANCE-WIRES. James I. Ayer, Cambridge, Mass., assignor to Simplex Electric Heating Company, Boston, Mass. Filed December 6, 1906. Two loop forming devices are arranged to lay the loops alternately in opposite directions.

905,131. ELECTROMAGNETIC STOP MECHANISM FOR SHUTTLE-LOOMS. Daniel Bacon, New York, N. Y. Filed February 8, 1907. An electrically-operated clutch governs the movements of the driving shaft of the loom.

905,136. ALTERNATING-CURRENT MAGNET. Thomas E. Barnum, Milwaukee, Wis., assignor to Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed April 15, 1905. There is an iron shroud surrounding the coil with an air-gap so proportioned that the self-induction of the coil will permit the passage of sufficient current to attract the armature, but when this is attracted only sufficient current can pass to maintain the armature in position.

905,141. INSULATOR. Lawrence L. Bogue, East Orwell, Ohio. Filed May 28, 1907. An elongated cylindrical body has continuous U-shaped grooves intersecting at its rounded ends.

905,159. ELECTRIC HEATER. Austin C. Dunham, Hartford, Conn. Filed April 16, 1907. An electric radiator comprises a corrugated receptacle with a central casing dividing it into communicating chambers with an electric-heating coil in the bottom portion.

905,176. DEVICE FOR SUSPENDING BATTERY-CRADLES. Emil Gruenfeldt, Cleveland, Ohio, assignor to The Baker Motor Vehicle Company, Cleveland, Ohio. Filed January 23, 1908. A series of independent hangers for suspending the storage battery in an electric vehicle.

905,229. ELECTRIC CALL-BELL. Christian Reinker and William Reinker, Lakewood, Ohio. Filed April 27, 1908. A separate magnetically-controlled device is adapted to limit the vibratory movement of the hammer to a buzzing sound.

905,230. ELECTRICAL CONDUCTOR FOR DYNAMOS. Walter J. Richards, Milwaukee, Wis., assignor to National Electric Company, Milwaukee, Wis. Filed August 15, 1904. A pigtail carbon brush.

905,266. SIGNAL APPARATUS. Leonidas G. Woolley, Lima, Ohio, assignor to John C. Riley, Lima, Ohio. Filed August 31, 1906. A magneto-electric signaling system includes a main-line testing mechanism having a magneto with an overbalancing weight.

905,308. AUTOMATIC RAILROAD SIGNAL. William H. Harris, Stark, Mont. Filed December 16, 1907. Electrically-operated block-signal system.

905,312. HEADLIGHT. Theron L. Hiles, Chicago, Ill. Filed July 23, 1908. An electric lamp is located in a parabolic reflector composed of glass silvered on its outer surface.

905,326. ELECTRICAL TEMPERATURE READER AND RECORDER. George E. Kirk, Toledo, Ohio, assignor to William A. Baker, Toledo, Ohio. Filed June 26, 1907. Contains an indicating instrument and a temperature-measuring instrument capable of producing variation in a resistance.

905,327. ELECTRIC SIGNALING SYSTEM. Edward E. Kleinschmidt, New York, N. Y. Filed August 7, 1907. An alternating-current system for a direct-current railway has a transformer in each block.

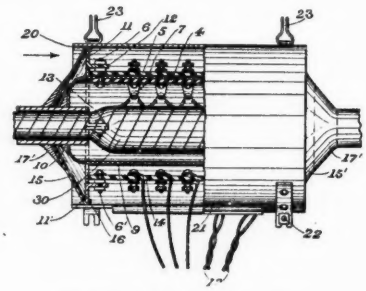
905,347. CABLE TERMINAL. James E. McMeen, Galesburg, Ill. Filed May 21, 1906. A sealed sleeve contains a set of insulated terminals; a second set of terminal posts is supported by the flanges of the sleeve, and a cover is clamped upon the flanges, forming a housing for both sets of terminals.

905,349. SEAL FOR ELECTRIC WIRES. Orrie W. Neal, Burton W. Shaw and Harry J. Howarth, Portland, Me. Filed August 15, 1908. A seal for the ends of insulated wires consists of a two-part casing adapted to inclose the bare ends.

905,351. TROLLEY RETRIEVER. Clarence Norland, Los Angeles, Cal. Filed March 7 1907. A casing contains a reel and a slack-adjusting spring connected therewith.

905,361. METHOD OF PRODUCING AND UTILIZING OZONE. Henry N. Potter, New Rochelle, N. Y., assignor to Cooper-Hewitt Electric Company, New York, N. Y. Filed January 6, 1904. The method consists in passing current between the electrodes inside a container previous to ozonizing radiation.

905,364. FLOOR BOX AND RECEPTACLE. Nelson H. Raymond, Trumansburg, N. Y., assignor to Alice C. Patterson, New York, N. Y. Filed July 7, 1908. A socket is mounted on a saddle in the receptacle.



905,347.—CABLE TERMINAL.

905,370. DELIVERY APPARATUS FOR DELIVERING MAIL, PARCELS, OR THE LIKE. Shelton H. Roby, Dublin, Ga. Filed January 9, 1908. A suspended carrier system has means for energizing the track wires and connections for leading the current to and from the motor of the carrier.

905,378. FIRE AND TEMPERATURE ALARM OR INDICATOR. George L. Smith, Aberdeen, Scotland. Filed May 22, 1908. A pneumatically controlled electric fire and trouble alarm.

905,402. METHOD OF REMOVING CARBON FROM METALLIC FILAMENTS. Werner von Bolton, Charlottenburg, Germany, assignor to Siemens & Halske, A. G., Berlin, Germany. Filed June 2, 1908. The method consists in highly electrically heating the film containing the carbon in an atmosphere of acetic acid vapors.

905,414. METALLIC INSULATOR PIN. Charles G. Ette, St. Louis, Mo., assignor to Ette Investment Company, St. Louis, Mo. Filed December 24, 1907. Consists of two sections that are provided on their longitudinal edges with interlocking teeth.

905,458. GLOBE CLEANER FOR ARC LAMPS. Robert H. Read, Schenectady, N. Y., assignor to General Electric Company. Filed October 25, 1906. In combination with the inner globe

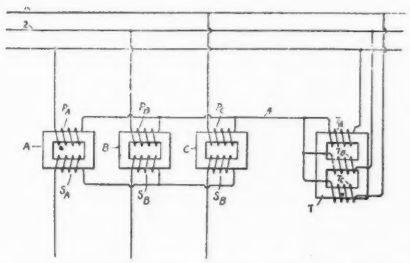
are electromagnetic means for rotating it and one or more stationary wipers inside the globe.

905,459. FLAT-IRON STOVE. Edwin W. Rice, Jr., Schenectady, N. Y., assignor to General Electric Company. Filed May 11, 1908. A flat-iron stand comprises an upwarding projecting support for an iron and contact terminals adjacent thereto.

905,468. ELECTRIC SIGN. John P. Shearer, Nyack, N. Y. Filed April 16, 1908. A casing has panels mounted in it and a bar carrying the lamp support.

905,478. INCANDESCENT LAMP. Alfred Swan, New York, N. Y., assignor to General Electric Company. Filed June 7, 1905. A portion of the leading-in wire is curled up in a cavity in the web.

905,483. ELECTRIC-LIGHT-BULB SHIELD. Benjamin R. Williams, English, Ark. Filed March 18, 1908. Each of a pair of shields adapted to enclose the bulb is provided with a neck fitting the neck of the socket, and a binding-band encircles the necks of the shields.



905,509.—THREE-PHASE DISTRIBUTION SYSTEM.

905,495. ELECTRORESPONSIVE DEVICE. Edward A. Buckman, Chicago, Ill., assignor of one-half to Harry L. Felio, Chicago, Ill. Filed July 1, 1907. An electromagnet comprises a spirally-advancing laminated core, laminated pole pieces and a coil wound on the core.

905,497. TELEGRAPH TYPEWRITER. George A. Cardwell, New York, N. Y., assignor to American Telegraph Typewriter Company, New York, N. Y. Filed March 18, 1907. Consists of a number of main and secondary circuits and selectable magnets responsive to a characteristic kind of impulse.

905,503. NON-EXPLOSIVE FUSE. Frank B. Cook, Chicago, Ill. Filed May 3, 1906. An enclosed fuse is filled and sealed so as to exclude all air therefrom.

905,508. CONTROL OF SEPARATELY EXCITED GENERATORS PROVIDED WITH AUXILIARY POLES. Lionel Fleischmann and Georg Stern, Berlin, Germany, assignors to General Electric Company. Filed March 11, 1908. The generator has an auxiliary series field and means for "killing" this when the main field circuit is broken.

905,509. SYSTEM OF DISTRIBUTION. Lionel Fleischmann, Berlin, Germany, assignor to General Electric Company. Filed April 10, 1908. A three-phase system has three single-phase transformers Y-connected and a three-phase Y-connected reactance, with its neutral point connected to the neutral point of the single-phase transformers.

905,512. DYNAMO-ELECTRIC MACHINE. Charles M. Green, Lynn, Mass., assignor to General Electric Company. Filed August 12, 1903. The armature has a shield formed of a strip of woven fabric cut on the bias and means for gathering the edges of the strip to cause it to closely embrace the armature.

905,513. SIGNAL SYSTEM. John L. Hall, Schenectady, N. Y., assignor to General Electric Company. Filed January 30, 1908. A number of receiving devices are provided with magnet windings.

905,514 and 905,515. ARC LAMP. Cromwell A. B. Halvorson, Jr., Lynn, Mass., assignor to General Electric Company. Filed October 31, 1906, and April 6, 1907. There are means for operating the negative electrode to cause it to strike the positive one. The second patent describes the clutch mechanism.

905,520. FEED MECHANISM. Bengt M. W. Hanson and Frederick W. Post, Hartford, Conn., assignors to Pratt & Whitney Company, Hartford, Conn. Filed April 12, 1907. An electric circuit has a member provided with means for limiting the action of the feed mechanism.

905,537. RECEIVER ARRANGEMENT FOR WIRELESS TELEGRAPHY. Gerhard Jahr, Berlin, Germany. Filed June 12, 1907. Comprises a coil, a receiver, adjustable terminals therefor, a lever connected with one of the terminals and adapted to contact the other terminal under the action of electric waves.

905,554. INSULATED CONDUCTOR. Joseph I. Mitchell, Schenectady, N. Y., assignor to General Electric Company. Filed September 14, 1903. The conductor for use in making edgewise-wound coils consists of a flat strip and a flat strip of insulating material adjacent to one side.

905,557. ARC-LIGHT ELECTRODE. Berthold Monasch, Berlin, Germany, assignor to General Electric Company. Filed May 16, 1906. Composed of one or more metallic compounds mixed with several per cent of silicon carbide.

905,572. METHOD OF STRIKING VOLTAIC ARCS. Albert J. Petersson, Alby, Sweden. Filed November 3, 1905. The method consists in leading gases through a furnace chamber, striking arcs between the electrodes and moving the arcs by means of magnetic action to electrodes of other circuits of higher intensity.

905,588. ELECTRIC CONTROLLER. Ralph R. Root, Cleveland, Ohio. Filed February 8, 1906. A resistance controller there are provided a pair of carbon pencils and solenoids for moving one pencil so as to increase the distance between them and thereby produce resistance.

905,589. SYSTEM FOR CONTROLLING MOTORS. David E. Ross, Brookston, Ind. Filed May 18, 1907. A pneumatically-operated controller for traction motors.

905,594. DEVICE FOR LOCATING A MOLTEN DISTRIBUTING FUSE. Ferdinand Schultz, Münster, Germany. Filed February 15, 1907. The fuse on melting opens an electric connection between the feeder and pilot wires, and indicates its location by a voltmeter at the central station.

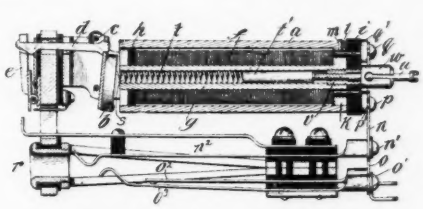
905,597. ELECTRIC FLUID HEATER. James S. Smyser, Harwich, Mass., assignor to General Electric Company. Filed April 4, 1908. Comprises a fluid receptacle and a pair of electrodes therein, each composed of parallel-spaced plates connected at one end.

905,599. NEGATIVE-POLE ACCUMULATOR ELECTRODE. Edward Sokal, Chicago, Ill. Filed August 22, 1907. Consists of a perforated envelope completely filled with active material containing a small percentage of lead dust.

905,619. TELEPHONE-EXCHANGE APPARATUS. Ernest E. Yaxley, Chicago, Ill., assignor to Monarch Telephone Manufacturing Company, Chicago, Ill. Filed September 26, 1905. A combined magneto drop and spring jack.

905,621. ALTERNATING-CURRENT HIGH-FREQUENCY GENERATOR. Ernest F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed February 6, 1905. An inductor-type alternator has two rotating discs tapering toward their center and carrying projections on the inner sides of the peripheries.

905,625. EXPLOSION ENGINE. Elmer Apperson, Kokomo, Ind. Filed July 3, 1906. A pair of spark plugs extends into the cylinder, one being connected to a magneto and the other to a battery.



905,619.—TELEPHONE DROP AND JACK.

905,628. TELEGRAPHIC REPEATING APPARATUS. William E. Athearn, New York, N. Y., assignor to American Telephone and Telegraph Company. Filed April 29, 1908. The circuit has at each of two stations a current-reversing transmitter and a polarized relay.

905,666. ELECTRODE. Albert G. Davis, Schenectady, N. Y., assignor to General Electric Company. Filed July 29, 1904. In an apparatus for electrical treatment of gases there are electrodes containing magnetite and means for establishing an arc between them.

905,675. BRUSH HOLDER. Hermann F. T. Erben, Schenectady, N. Y., assignor to General Electric Company. Filed October 17, 1903. A pivoted frame to which the brush is rigidly secured is provided with a spring having an adjustable spiral portion and reversely curved portion.

905,697. MOTOR-CONTROL SYSTEM FOR ELECTRIC VEHICLES. Max R. Hanna, Schenectady, N. Y., assignor to General Electric Company. Filed March 16, 1908. There are a number of electrically-controlled switches for connecting and regulating two pairs of motors and a master controller governing the controlling switches.

905,703. INCANDESCENT ELECTRIC LAMP. Herman J. Jaeger, New York, N. Y. Filed November 4, 1907. Construction of a multiple metallic-filament lamp is described.

905,713. SELF-REGULATING ELECTRICALLY-PROPELLED VEHICLE WITH LIMITED VARIATIONS IN INTENSITY. Louis Krieger, Paris, France. Filed January 10, 1906. A generator arranged to deliver constant watts has an exciter.

905,734. AUTOMATIC SELF-STARTER. Charles H. Miller, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Filed April 10, 1905. An electromagnetically operated starter for electric motors.

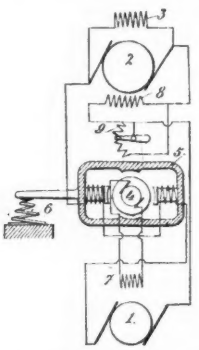
905,746. OPERATING DIRECT-CURRENT GENERATORS IN MULTIPLE. Frank W. Peek, Jr., Schenectady, N. Y., assignor to General Electric Company. Filed April 8, 1908. There is a voltage regulator for each generator containing a main-control magnet having a differential winding.

905,752. POWER-GENERATING SYSTEM. Edmond Rosenberg and Edgar W. Mix, Paris, France, assignors to General Electric Company. Filed April 23, 1907. There are in combination an electric generator, a turbine driving the same, a flywheel located in a chamber and a condenser which creates a vacuum in the chamber to decrease rotation losses of the flywheel.

905,761. SEALING-CAP FOR ELECTRICAL APPARATUS. Joseph G. Swallow, Brooklyn, N. Y., assignor of one-half to Frank W. Smith, New York, N. Y. Filed March 6, 1908. A reversible perforated cap is provided with an opening for the appliance.

905,773. GROUNDING CLAMP FOR ELECTRIC WIRES. Wheeler H. Vibber, New London, Conn., assignor of one-half to the Gillette-Vibber Company, New London, Conn. Filed April 11, 1908. A wrought-metal strap is bent to a circular form and has two projections which are perforated for the reception of the binding-screw.

905,781. TELEPHONE RECEIVER. Nathaniel Baldwin, Heber, Utah, assignor of one-half to William Witt, Heber, Utah. Filed January 29, 1908. A magneto telephone has a permanent magnet, an armature and means for causing both poles of the magnet to act on each side of the armature.



905,713.—SELF-REGULATING GENERATOR.

905,782. ELECTROMAGNETIC SWITCH. Thomas E. Barnum, Milwaukee, Wis., assignor to Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Original application filed April 15, 1905. Divided and this application filed July 5, 1906. This is a modification of No. 905,136.

905,784. MOUNTING FOR TROLLEY HEADS. Joseph J. Bennett, Pittsfield, Mass., assignor of one-half to Loando B. Estes, North Adams, Mass. Filed August 6, 1906. There is an arm integral with the base piece and adapted to be mounted in the upper end of the trolley pole.

905,785. ELECTROLYTIC SOLUTION FOR ZINC PLATING. Celestino Bianco, New York, N. Y. Filed July 16, 1907. Contains sulphates of zinc and iron and acetate of sodium.

905,790. MOTOR CONTROLLER. Albert H. Buckelew, Newark, N. J. Filed February 21, 1905. The pilot motor actuates the controller step by step and a pair of directional switches controls the pilot motor without stopping the main motor in going from one position to another.

905,792. SNAP SWITCH. Frank S. Capello, Schenectady, N. Y., assignor to General Electric Company. Filed October 8, 1907. In combination with the spindle are catch-plates having a slot and an actuator engaging the slot and adapted to slide transversely of the spindle.

905,797. ALTERNATING-CURRENT CLUTCH. Albert G. Davis, Schenectady, N. Y., assignor to General Electric Company. Filed March 27, 1908. A magnetic clutch has two movable members, one with a laminated core and a winding thereon and the other with a short-circuited conductor in inductive relation to the winding.

905,800. ARC LAMP. John T. H. Dempster, Schenectady, N. Y., assignor to General Electric Company. Filed February 29, 1904. Renewed April 7, 1906. Comprises a non-consuming electrode, a consuming electrode co-operating therewith and means for heating the former to thereby heat the latter electrode.

905,805. DYNAMO-ELECTRIC MACHINE. Samuel S. Forster, Schenectady, N. Y., assignor to General Electric Company. Filed July 20, 1905. The teeth of a laminated armature core are provided with U-shaped stiffening members.

905,812. ELECTRICAL CONNECTOR. Preston E. Gilling, Camden, N. J., assignor to Novelty Electric Company, Philadelphia, Pa. Filed March 20, 1906. Comprises a piece of tubing with a section flattened and bent into a loop to form a clamp having a terminal with a socket.

905,814. DYNAMO-ELECTRIC MACHINE. Charles M. Green, Lynn, Mass., assignor to General Electric Company. Original application filed August 12, 1903. Divided and this application filed November 8, 1904. The pole shoe is formed of iron laminated perpendicularly to the plane of revolution of the armature.

905,815. APPARATUS FOR THE MAGNETIC SEPARATION OF ORE. Gustaf Gröndal, Djursholm, Sweden. Filed June 25, 1907. A set of magnets is arranged above the overflow between the vessels.

905,816. CLOCK. Augustus L. Hahl, Chicago, Ill., assignor to Hahl Automatic Clock Company, Chicago, Ill. Filed September 26, 1903. An electromagnet is energized at predetermined intervals thereby actuating the rack bar and winding the spring.

905,817. DYNAMO-ELECTRIC MACHINE. Fred B. Howell, Schenectady, N. Y., assignor to General Electric Company. Filed April 17, 1908. A pole piece comprises laminations and fastening bolts therefor extending all the way through the pole piece.

905,819. AUTOMATIC CARRIER SYSTEM. Carl W. Larson, Schenectady, N. Y., assignor to General Electric Company. Filed January 2, 1906. An automatically-controlled and electrically-driven cable moves the car.

905,824. ELECTRIC EXHIBITOR. Bert H. Winters, Annapolis, Md. Filed December 17, 1907. A casing with a sight opening contains a drum revolved by an electromagnet and an electric-lighting arrangement.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 8, 1908:

464,490. ELECTRIC RAILWAY SIGNAL. C. E. Buzzell, Leaf River, Ill.

464,505. CONDUIT CONDUCTOR FOR ELECTRIC RAILWAYS. W. H. Knight, New York, N. Y.

464,510. AUTOMATIC FIRE-ALARM TELEGRAPH. M. Martin, Malden, Mass.

464,513. ELECTRIC FARE-RECORDING SYSTEM. B. S. Molyneaux, Minneapolis, Minn.

464,540. TIME-REGISTERING DEVICE FOR ELECTRICAL CURRENTS. W. D. Wilder and W. Cobb, Jr., Brockton, Mass.

464,547. ARMATURE WINDING FOR DYNAMO-ELECTRIC MACHINES. C. R. Arnold, Philadelphia, Pa.

464,557. ELECTRIC RAILWAY SYSTEM. L. O. Dion, Natick, Mass.

464,643. PROTECTOR FOR TELEPHONES. J. L. W. Zietlow, Aberdeen, S. D.

464,665. SECONDARY BATTERY. I. L. Roberts, Brooklyn, N. Y.

464,666. ELECTROMAGNETIC MOTOR. N. Tesla, New York, N. Y.

464,667. ELECTRICAL CONDENSER. N. Tesla, New York, N. Y.

464,676. ELECTRODE FOR SECONDARY BATTERIES. W. Morrison, Des Moines, Iowa.

464,677. ELECTRICAL TRANSFORMER. A. Poleschko, St. Petersburg, Russia.

464,682. ELECTRIC ARC LAMP. A. G. Waterhouse, Hartford, Conn.

464,683. ELECTRIC METER. A. G. Waterhouse, Hartford, Conn.

464,780. TROLLEY FOR ELECTRIC RAILWAYS. J. W. Schlosser, Washington, D. C.

464,822. SYSTEM OF DISTRIBUTING ELECTRICITY. T. A. Edison, Menlo Park, N. J.

464,897. TELEGRAPH KEY. L. F. Robare, Au Sable Forks, N. Y.